THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XVII. No. 415—20th YEAR.] LONDON, SEPTEMBER 15, 1868. [Subscription per Ann. { 15s. in Advance / 18s. Credit.] DOUBLE No. Price 1s.

RAMSAY'S NEWCASTLE CANNEL

COAL. Analysis by Dr. FYFE, M.D.:—
9746 cubic feet of gas per ton of coal.
26-candle gas.
13¼ cwt. coke per ton of coal.
N.B.—Ramsay's Cannel most resembles the Marquis of Lothian's Cannel, but superior as to coke.
RAMSAY'S PATENT CONDENSED COKE,
DO. GARESFIELD COKE.

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GAS-RETORTS, introduced 1828.
FIRE-BRICK WORKS, established 1804.
FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire Clay.
The Fire Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article.
The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the works are the most extensive in the Kingdom.
Manufactories: DERWENTHAUGH, SWALWELL, and HEBBURN QUAY. Offices: BROAD CHARE, NEWCASTLE-UPON-TYNE. Address, G. H. RAMSAY.

GEORGE GLOVER & CO.,
Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.

These Meters are warranted to measure correctly and not to vary, and have come into general use more rapidly than any Meters hitherto manufactured.

1862.

CLASSES X. AND XXXI.

CLASS X.—"*For ingenuity, completeness, and efficiency of apparatus used in measuring gas, and for excellence of material and workmanship.*"
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IMPROVED GASLIGHT.

Ample experience has proved that, by carburetting common gas, its illuminating power may be doubled or even tripled, and its consumpt greatly lessened. Wax candles and oil lamps in consequence are being rapidly superseded, and gas is now used in many private houses and mansions where formerly it was not tolerated.
Information as to the apparatus, fluids, &c., may be had of GEO. GLOVER and Co., or CARLESS, BLAGDEN, and Co., HACKNEY WICK, N.E.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.

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THE OLD TUBE WORKS,
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ALMA WORKS,
WALSALL, STAFFORDSHIRE;
and 69, UPPER THAMES STREET, LONDON,
Original Manufacturers of Wrought-Iron Gas Tubes and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest Orders may be executed in a few days.
Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanised Tubes, &c.
N.B. All Goods thoroughly Tested before sent out, and Warranted.

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AND
STREET-LAMP
MANUFACTURERS,
BELL BARN ROAD, BIRMINGHAM.
ESTABLISHED 1830.
All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

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NEAR NEWCASTLE-ON-TYNE.

WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the Manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other Articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.
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These Cannels are extensively used in the Gas-Works of Edinburgh, where the illuminating power of the gas is the highest in Britain.
The yield per ton is 12,573 cubic feet; illuminating power 33·8 standard candles; coke per ton 1046 lbs.
Ports of Shipment, in the Firth of Forth.

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NOTICE.
LESMAHAGO GAS OR CANNEL COAL.

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The Proprietors will, in future, use their own forms of bills of lading, and also issue certificates of origin, signed, as the case may be, either by JAMES FERGUSON & Co., or by the NITSHILL & LESMAHAGO COAL COMPANY; and they request all consumers purchasing Lesmahago Coal to demand such a certificate for each cargo, and to observe that it corresponds with the bill of lading.
Auchinheath, Lesmahago, March, 1868.

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Patentees of the Standard Gasometers for the Government,

TWO MEDALS,

LONDON, 1862.

HAVE OBTAINED THE

HIGHEST

PRIZE

FOR

SILVER MEDAL,

PARIS, 1867.

IMPROVED DRY GAS-METERS AND GASOMETERS,

AT THE

PARIS EXHIBITION.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S W.;

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These Retorts are now used at more than 60 Gas-Works, and continue to give satisfaction.

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W. COCHRANE CARR, Newcastle-on-Tyne.
W. FRASER, Inverkeithing, N.B.

Full particulars, with illustrated circular, testimonials, and prices, will be forwarded on application to A. C. FRASER, Gas-Works, COLCHESTER.

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FIRE-BRICKS, LUMPS, SQUARES, and TILES of all dimensions.

GAS-RETORTS always in stock.

GARDEN EDGINGS of various patterns.

ORNAMENTAL BUILDING BRICKS.

GRATE BACKS in various designs.

Contracts entered into to set Retorts, erect Furnaces, &c.

Shipments on the shortest notice.

Makers of A. C. FRASER'S Patent Ribbed Retorts and Brick Ovens.

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BEFORE PURCHASING SEND FOR GRIFFITHS' MONTHLY LIST OF SAFES,

By Milner, Marr, Thos. Perry and Sons, Mordan, Price, Whitfield, and every eminent maker, at about half the price of new.

A guarantee given with each.

A large quantity of TANN'S SAFES from £2 10s.

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Bentley's Improved D Brick Segment Retorts, 5 or 3 in one bed.

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BRIGG, LINCOLNSHIRE.

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This material is a natural Oxide, and is supplied to Gas Companies as taken from the Mines, without any admixture of deleterious matter. It acts freely, and will purify a much larger quantity of gas per ton, than the generality of the material now in use under this name.

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FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

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See Description and Sketch in "JOURNAL OF GAS LIGHTING," March 31, 1868.

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A—Above-ground Screw Gas-Valve, with improved indicator to show when open and shut, is the best kind of Valve for heavy pressures, such as the oxide of iron purification.

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STATION-METERS ANY SIZE.
PHOTOMETERS, EXPERIMENTAL METERS,
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Price List on application.
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INTERNATIONAL EXHIBITION,
1862. CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and "HONOURABLE MENTION" for good quality of Fire-Bricks.

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FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
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HANCOCK'S INDIA-RUBBER GAS-TUBING.

All sizes, from ⅛ in. to 4 in. diameter and upwards.
Also,
HORSE SINGEING APPARATUS, best make, with GAS-BURNERS, COMBS, and INDIA-RUBBER TUBING, all complete.
INDIA-RUBBER BAGS for GAS-MAINS.
WASHERS for GAS and STEAM JOINTS.
VALVES (pure solid Rubber) for STEAM-ENGINES.
PACKING (Elastic) for STEAM-ENGINES.
FLANGE TUBING, for excluding Draughts and Dust through WINDOWS, DOORS, and GLASS CASES.

Section.

Illustrated Price Lists on application.

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LONDON, E.C.

Established 1811.

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And every Description of
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Including
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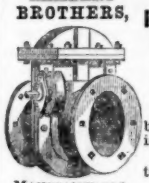

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N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

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Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, T-pieces, &c. &c.

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NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of Clay Retorts, Fire-Bricks, and every description of Fire-Clay Goods.

THE

UNIVERSAL EXHIBITION OF PARIS,

1867.

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DRY GAS-METER MANUFACTURERS,

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HAVE BEEN AWARDED THE HIGHEST PRIZE FOR

DRY GAS-METERS,

BY THE IMPERIAL COMMISSIONERS FOR THE

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(SUCCESSORS TO SAMUEL CROSLEY),

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Established 1816.

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"It is well known that in Meters constructed so that the valve will close when the water is drawn off to such a point as to render them 3 per cent. slow the lights are liable to be extinguished by the closing of the valve by a sudden increase of pressure. To meet this difficulty, Mr. Pinchbeck has invented an ingenious and simple arrangement by which the action is reversed, and any such increase of pressure, in his Meter, raises the value instead of depressing it. The act of the improvement having been adopted by Messrs. W. Parkinson and Co. is a sufficient guarantee that it practically and effectually remedies the inconvenience it is designed to meet."—JOURNAL OF GAS LIGHTING.

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STATION-METERS AND GOVERNORS.

Which can be seen at all the London Gas-Works. Also Liverpool, Manchester, Sheffield, Nottingham, Belfast, Glasgow, Birmingham, Dublin, Bristol, Leeds, Leicester, Brighton, Southampton, Sunderland, Wolverhampton, Bradford, Norwich, &c., &c.

TEST GASHOLDERS, EXPERIMENTAL METERS, EXHAUSTER REGULATORS,

MINUTE CLOCKS, PRESSURE GAUGES, PHOTOMETERS. PRESSURE REGISTERS, &c.

CONTENTS.

	PAGE
Notes upon Passing Events:—	
The Water Famine	673
The Doom of the Broad Gauge	673
The Cabmen's Strike	674
The International Congress of Working Men at Brussels	674
Cookery in Village Inns	675
Schools for Teaching Domestic Economy	675
Circular to Gas Companies:—	
The Board of Trade Appointments under the City of London Gas Act, 1868	675
Register of New Patents:—	
Salmon, P.—Manufacture of Gas	676
Chalmers, T.—Producing Seamless Tubes	677
Parkes, J. J.—Ventilating Rooms and Buildings	677
Steane, S. E. T.—Globes and Glasses for the Transmission of Light	677
Price, E.—Regulating the Supply of Gas to Burners	677
Wilson, J. H.—Water-Closets and Pumps	677
Herring, W. H.—Warming Buildings	677
Sterry, A. C.—Engines worked by Heated Air or Gas	677
Kerby, C.—Materials to be used for Filtering Liquids	677
Barker, C. M.—Socket and Flange Spigot-Pipes	678
Bessemer, H.—Fire-Bricks, Tiles, &c.	678
Kerby, C.—Apparatus for Filtering Liquids	678
Applications for Letters Patent	678
Grants of Provisional Protection	679
Invention Protected for Six Months	679
Notices to Proceed	679
Parliamentary Intelligence:—	
House of Commons Committee—Derby Water-Works Bill	679
Miscellaneous News:—	
Metropolis Gas Supply—City Court of Sewers	684
Meeting of the Canterbury Gas and Water Company	684
Fatal Gas Explosion at Weymouth	685
Meeting of the South Shields Gas Company	686
Unlawful Appropriation of Water	686
Utilization of Sewage	686
Pollution of the River Aire	686
Halifax	686
Brighton and Hove General Gas Company	687
North British Association of Gas Managers	687
Obituary—M. Jacques Dubochet	689
Dr. Hillier's Report on the Gas supplied by the Imperial Gas Company to the Vestry of St. Pancras during the Months of July and August, 1868	689
Gas Explosion at the Bradford Theatre	689
Fatal Gas Explosion at Stratford	689
The Margate Town Council and the Gas Company	690
Return by the Metropolitan Association of Medical Officers of Health of the Average Composition and Quality of the Metropolitan Waters in August, 1868	690
Dr. Frankland's Analysis of the Metropolitan Waters in August, 1868.	690
Share List of Metropolitan Gas Companies	690
Price Current	691

TO CORRESPONDENTS.

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NOTICES.

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THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, SEPTEMBER 15, 1868.

Notes upon Passing Events.

THE maxim that "an ounce of fact is worth a pound of theory" is as true as it is old. The droughty season has offered an example of this in the matter of water-works. The theory in fashion amongst the sanitary philosophers is to invariably provide a water supply by impounding reservoirs, and to abandon the use of rivers even where the works are completed, and the supply practically pure, as in the case of the Thames. Mr. Chadwick, C.B., is the patron of this theory, and it is not his fault that nearly twenty years ago London did not exchange its ancient unfailing sources for a supply to be collected on the Bagshot sands and the Surrey hills. The scheme, set forth with all the skill and vehemence of the old Board of Health, will be found in full detail in a set of Blue-Books widely circulated at national expense. "A new system of water supply, "with a new system of drainage, and a new application of "sewerage," were the foundation of Mr. Chadwick's onslaughts on all the experience and science of engineers who did not enlist in his army of "Rawlinsons." Very recently Dr. Farr had influence enough to induce almost every daily paper to publish in prominent type his report in favour of seeking the water supply of London in the mountains of Cumberland, at an expense of some nine or ten millions, and abandoning the rivers which have never yet failed to meet the demands of the whole metropolis; this vast sacrifice of existing capital being justified on grounds which Dr. Letheby and other independent scientific authorities have shown to be utterly fallacious. Keswick has been nearly without water this summer; while Manchester, the model city of water-supply theorists, whose works are not under the control of a trading, dividend-paying company, but have been executed and are managed by the municipality, is nearly *à sec*—nearly waterless. Two out of three reservoirs in the dampest climate in England are empty; the third contains a little brown repulsive looking liquid. At a recent meeting of the Town Council, the chairman of the Water-Works Committee stated that they hoped, by stopping the supply from six o'clock in the evening until six o'clock in the morning, and by reducing the compensation to the millowners on the Ethrow valley, to make the supply hold out for five or six weeks longer!

Let us imagine London in the same condition—dependent on a lake of Cumberland—and the Government held responsible by Clerkenwell and Shoreditch for their thirst. Liverpool, which is not fortunate enough to have a Thames and a Lea to draw on, owes its superior condition this year to Manchester to drawing a portion of its supply from deep wells in the red sandstone, which has relieved the pressure on the Rivington reservoir. The *Daily News* has lately devoted an article to the necessity of constant supply, a change we have frequently pressed the metropolitan water companies to adopt, without waiting for the compulsion of an angry Act of Parliament. We are surprised to find a journal, generally sound in its political economy and warm in its admiration of the works of private enterprise, echoing the cant against the supply of water by dividend-paying companies. Where a town begins at the beginning, there are many instances in which a municipality may wisely undertake such works; but, in the case of London, the inhabitants had been by private enterprise supplied abundantly with water for at least half a century (not counting the river) before our imperial or local Government thought of such matters. If now it is considered desirable that the municipal representatives of London should have the management of the water supply, they must purchase the existing water-works, and the ratepayers, in the price, will pay existing dividends as long as London lasts.

At their last meeting, the Great Western Railway Company's shareholders were addressed by their chairman, the engineer, Sir Daniel Gooch, in a speech which must have been heart-breaking to the victims of the original scheme, if any were present. The Great Western was especially a gentleman's railway. It was not started on the narrow old-fashioned commercial principles of the Liverpool and Manchester men. The list of shareholders contained the names of more noblemen, gentlemen, and especially of clergymen, than any other joint-stock undertaking of the time. Brunel was never in any sense the officer of the Great Western Board. He was their master, even on financial questions, and the secretary was the engineer's premier and chancellor of the exchequer. Not having been fortunate enough to invent any part of the railway system which the prophetic genius of George Stephenson planned out from the first—a system of universal intercommunication of conveyances for passengers and goods—Brunel sought for fame and success by making everything bigger than any one had ever made before. The whole of the Great Western line was one vast experiment in bigness. His successors have found that bigness and greatness are very different things, and now the memory of Brunel must be chiefly kept alive by the greatness of his failures. The wide rails, the broad carriages, the mammoth locomotives to match,

sailing steadily along at previously unattempted speed, caught and conquered men's minds on their vulgar side. The Great Western was such a truly gentlemanly conveyance. To take a royal and noble party to Windsor or to Ascot nothing could be more perfect. Philosophers of the desk could see no difficulty in filling any train with goods or passengers. To them dead-weight—the great enemy of railway profits—presented no difficulties. As long as the Great Western worked along its own main trunk line, without touching any other system, the defects of an exaggeration of carriages, goods, trucks, and engines did not appear to the outside public. The profits of railway companies were in those days thought to be unlimited, and expenses of working a matter of no manner of consequence. When a junction between the broad system and the narrow system became inevitable, and the theory that the Western district would never have anything to do with the Midland and Northern was contradicted by a railway from Birmingham running into Gloucester, the engineer of the gigantic school was able to convince committees of both Houses of Parliament that nothing would be easier than to transfer all manner of merchandise from one railway to another by mechanical means. We remember seeing the farce of transferring coal-boxes from a broad gauge to a narrow gauge truck performed at Paddington before an admiring crowd of peers and peeresses, M.P.'s, and their wives. When this trick had failed in practice, but served its purpose by helping the broad gauge interest to new conquests of territory—the district theory had previously been given up—each conquest more disastrous to the victor's interest than the previous one—the third rail plan was invented. As if a broad gauge system was not expensive enough alone, a third rail was laid down to accommodate narrow gauge traffic. By these dodges the Great Western Company travelled to Birmingham and the Staffordshire mines, to South Wales, and almost rivalled the London and North-Western in its mileage. Talents of an ambassador of the first order were exerted by Mr. Saunders in securing parliamentary influence, and, with Mr. Brunel for a witness, contests between the broad gauge and uniformity of gauge became merely a walk over for the former. Having conquered everything worth conquering, the price of shares fell first, and then the profits. The broad gauge lines became all but insolvent; the glory of management departed; shabby carriages, unpainted stations, and a scarcity of porters showed the decline of the system. Mr. Brunel died before the total failure of his plans had been acknowledged by the public. Mr. Saunders, who would have been one of the first ministers of state of a Napoleon, died too, having lived to see all his wonderful successes turn to grief, vanity, and vexation; and, finally, every member of the original Great Western board having disappeared, it was reserved for one of Mr. Brunel's pupils to announce that the hopes of the shareholders in future dividends lay in the utter destruction of the broad gauge system, and the adoption of that "national "uniformity of gauge" which was preached to deaf ears twenty years ago. Those who wish to understand the difference between genius and cleverness, cannot do better than study the lives of the uneducated, or self-educated, George Stephenson, and the highly accomplished Brunel—the former one of the worst, and the latter one of the best witnesses that ever was cross-examined. George Stephenson was a mechanic who sought always to do work at the least expense and with the least expenditure of power. From his inner consciousness he foresaw all the results of the railway system. Brunel's great object seems to have been to astonish the gaping world by something very big and very costly. His talent was chiefly shown in getting out of scrapes created by himself. The engineer who treats cost as a matter of no consequence, and keeps in view always his own glory, or rather glorification, may find a place in the service of a despotic monarch, but will not achieve a permanent reputation where he has either shareholders or taxpayers for his masters. The race of patient or poetical shareholders is extinct. Engineers who desire to succeed now must above all study utility and economy.

The cabmen, not having the funds of a wealthy trades union at their back, have failed in the attempt to coerce the railway companies by punishing the public. But, although this cab strike has been a failure, it would be a mistake to suppose that the cab question is settled. The London public are profoundly dissatisfied with the condition of public conveyances. They are inferior to those of other cities of England in construction and management. The cause of this inferiority to Birmingham, Edinburgh, or Liverpool, is to be found in the heavy taxation imposed and the small accommodation afforded to cab-owners and cabmen. The tax is something like £20 a year per cab, including the driver's licence, and for this the cabman does not even get a stand, but only leave to take a place if vacant. There are about two thousand cabs out every day for which there is no room on any stand. The London and North-Western Railway admit as many cabs as their Euston station can accommodate at a nominal fee, when passed as in decent condition by an officer appointed for the purpose. They also provide a room, warmed and lighted, where the men can cook their meals without any expense. It is to an extension of dépôts of this kind that we must look for an improvement in London cabs, and in a reduction of the duty. Let central covered yards be established in as many districts as possible, open to cabs on payment of a fee, with, where needed, also a room for the men, *undisturbed by evangelical regulations or tract distributers*. If these yards or dépôts were placed in communication by notice boards, or even telegraph wires, with post-offices, fire-engine stations, and police-offices, the wear and tear of carriages, harness, horses, and drivers clothes would be less, and there would be encouragement for a better class of cabs at more than 6d. a mile, and less than the cost of a fly. It is easy for the well-clad passenger, warm from a dinner, with a purse in his pocket, and credit at a tailor's, if not at a bank, to find fault with the manners and morals of a weary, wet, hungry, penniless cab-driver; but it is not by turning a cold shoulder to the real grievances of the whole class that we shall get cab reform. Make the inspection by the police more severe, reduce the taxation, and provide, at public or parish expense, covered dépôts at low fixed charges, and self-interest, with the law of supply and demand, will produce better cabs, better horses, and better men.

The working men of Europe have been holding their international congress at Brussels, and enjoyed the stock satisfaction of abusing all other classes of the community and praising themselves as the only section of universal society capable of remaking the world on perfect principles. With the principal object of the meeting—the abolition of wages-work—it would be foolish to quarrel. All that the consuming world requires is to have its work done, and it is a matter of indifference to the unphilosophical world whether its wants are supplied by a master—that is, a contractor who pays wages—or a co-operative society. If Citizen Lucraft can inspire enough confidence in the other chair or cabinet makers of Clerkenwell to form a co-operative partnership on a great scale, in which wages, or, as they said at Brussels, "*le salariat*," is abolished, the purchasers will certainly ask no questions, but only look to the quality and price of the articles. Plain matter-of-fact people, after reading the fiery declamation against that tyrant and ogre, the capitalist, inquire why the discontented cannot debar themselves of a few of those luxuries in eating, drinking, and amusements on which artisans spend so much larger a share of their earnings than curates, Dissenting ministers, and clerks of the same income, in order to found associations in opposition to individual capitalists. There are, however, two reasons: first, it is much easier to make than either to save money or to have confidence in other workmen; and next, the moment a self-educated artisan has saved money, in ninety-nine cases out of a hundred, he makes arrangements for becoming a capitalist himself, instead of setting to work to regenerate the human race. It seems that, although whenever Citizens Lucraft, Odgers, Cremer, and Young address an audience of English working men, it is to show them what slaves Englishmen are, at Brussels it was incidentally admitted that only in England does sufficient liberty exist to enable the views of the association to be fully developed by discussions and publications, unless it be in Switzerland, where workmen on strike may also beat drums in the streets. Mr. Odgers did not attend the Brussels congress, because he was canvassing the borough of Chelsea. When he is returned to Parliament—as it is to be hoped he will be, in order that the views he represents may be, as it were, brought to a focus for examination—he will have some questions to answer which cannot be asked at trades union meetings; for instance, can any trades unionist tell why trades unions have always opposed and always submitted to the employment of machinery? The spinning-jenny, the sawing-mill, and the sewing-machine have been equally the objects of hostility; the brick-making machine is still opposed, and yet coming into use every day where "the stuff" will suit. A volume might be filled with

the names of labour-savers invented, opposed, destroyed, and yet adopted. We may be pardoned for not believing in the universal wisdom of the "*proletaire*," when we find him the opponent of cheaper clothes, cheaper food, and cheaper dwellings—opposed, in fact, to the interest of the consumer, of which he is one of the greatest. Clothed, fed, and warmed by machinery, he hates the *last* machine.

A travelling correspondent of one of our contemporaries complains that at a charming English village inn, where everything was neat and clean, and the neighbourhood picturesque and inviting, he was driven away by the total ignorance of cookery displayed by the hostess—nothing to be had except the tough steak and the eternal chop broiled, or a bit of meat boiled, while the few herbs in the garden were unused. This example was only one of a thousand. It seems to be a law of nature that no Englishwoman should have a taste for cookery, and no Frenchman for grooming. The French nurserymaid disdains to push a perambulator, but the French housekeeper revels in her kitchen. On this point our novelists are our best recorders. The curate or the village doctor, in an English novel, comes home to a burnt chop and three waxy potatoes; if he is very fortunate, something is kept warm for him in the oven, the something, at best, being a slice of roast shoulder of mutton with onion sauce. How differently does Dr. Mathœus, the medical hero of a charming French novel, live! He is only the doctor in a little German-French village, with an acre or two of garden and field; but his old housekeeper has famous coffee for him, and a fowl with rice for dinner. When he travels, with his Sancho Panza of a guide, at village inns he always finds at least an omelette with bacon (*omelette au lard*) at a few minutes notice. Indeed, every one who has travelled through the villages of France and Belgium must have been delighted at the facility with which eggs, butter, potherbs, a little bacon, a bullock's kidney, and haricot beans have been turned into a delicious repast, with the assistance of a glass or two of common wine. On the other hand, the impossibility of finding a French groom worth his salt, unless he was a native of German France, and trained in a cavalry regiment, is notorious.

We have managed within the last thirty years to popularize music in an extraordinary degree; the movement came from national and other parish schools. If the recommendations of the Education Commissioners are followed, in a few years every artisan who has been to school will know how to handle his pencil for the purposes of his trade. Leaving the followers of Miss Becker to pursue the cultivation of languages, the higher branches of mathematics, and natural philosophy, we hope that, in the new grand system of education for girls in primary schools, a space will be reserved for domestic economy. Oh! that we could enlist Mr. Cole, C.B.—or some one with the energy of Mr. Cole—in this crusade against meat wasted and husbands disappointed! Then we should see in village schools pictures of the familiar gridiron, frying-pan, and stewing-pan. Female teachers would abandon some of their painfully ambitious studies, and dive into the profitable discourses of Soyer, Acton, Beeton, and even Francatelli. Perhaps the Tract Society, which meddles with and muddles so many subjects, would direct one of the wielders of the scissors and paste-brush, who form part of their staff, to compound a tract on *the principles* of cookery, for the use of schools—a book which should explain the different arts of boiling, simmering, stewing, roasting, baking, frying, and *sauté*-ing; because these principles can be impressed without actual experiment. Teachers might demonstrate on a black board the joints and cuts of a sheep, a pig, a calf, and a bullock, and also the trimming operations required to make a joint presentable. Some benevolent and sensible ladies would, perhaps, institute school feasts, at which prizes might be awarded to scholars selected by competition in an examination in theory for the best hands at cooking a bullock's or a sheep's head, for frying potatoes, or making buttered toast. It would be found that parents would take much more interest in schooling if it led to some such practical results.

Circular to Gas Companies.

The Board of Trade have lost no time in discharging the important duty imposed on them by the City of London Gas Act of appointing gas referees, a chief gas examiner, and an auditor, the officers whose functions will be to carry into effect many of the provisions of the Act on which its successful operation will depend. The Act requires that at least one of the gas referees shall have practical knowledge and experience of the manufacture and supply of gas, and no one can question the qualification in that respect of Mr. Frederick John Evans, the well-known engineer of the Chartered Gas Company, who has been appointed one of those officers, with Mr. John Sampson Pierce and Mr. J. H. Patterson as his colleagues. Mr. Pierce is a civil engineer, and was, we believe, with the late Mr. Brunel, but for several years he has had the charge of some railways on his own account. Mr. Patterson is a member of the Society of Political Economy of Paris, and is favourably known as the author of two very able works—"The Economy of Capital" and "A Practical Treatise on the "Science of Finance." The gas referees are to continue in office for one year only from the date of their appointments, but they are capable of reappointment. Their duties are various, and many of them most onerous. It will devolve on them, in the first place, to inspect the works of the companies which supply the City with gas; to investigate the processes of manufacture, with the view of ascertaining the means adopted for purifying gas and of preventing nuisance; and to apply all tests they may think expedient for ascertaining the amount of sulphur, ammonia, or other impurity with which the gas may be charged—the companies being bound to give the gas referees and persons employed by them access to the works when required, and to afford them every facility for the execution of their duties. Having made that investigation, the gas referees are from time to time to ascertain the degree of purity with which each company can be reasonably required to make and supply gas continuously without occasioning a nuisance in the neighbourhood, and thereupon they are to prescribe the maximum amount of impurity in each form that shall be allowed, and the time from which the new standard is to be maintained, regard being had to the necessity for any alteration of the works. It is, however, provided by the Act that the gas shall be wholly free from sulphuretted hydrogen. The gas referees are also to prescribe the modes to be adopted for testing the purity and the illuminating power of the gas, the number of times of testing, the testing places, and the kind of apparatus to be provided by each company; such testing places to be not less than 1000 yards from the station from which the gas is supplied. The prescribed testing places, though to be provided by the gas companies, are to be under the control and management of the Corporation, but the companies may have separate testing places in the same buildings under their own control. The gas referees are to prescribe the burner for testing the illuminating power of the gas, which burner is to be "such as shall be most suitable for obtaining "from the gas the greatest amount of light, and be practicable "for use by the consumer." The average of all the testings of illuminating power presented by the gas referees each day is to be deemed to represent the illuminating power of that day. Their authority as to testing the illuminating power of the gas is, however, so far restricted that they cannot prescribe fewer testings than three times a day, at intervals of not less than one hour. Before the higher standard of illuminating power of 16 candles and the lower price of 3s. 9d. per 1000 feet come into operation, as provided by the Act, in 1870, on the recommendation of the gas referees, and with the consent of the companies and of the Corporation, the Board of Trade may substitute 14 or 15 candles for 16, with a proportionate reduction of price at the rate of 2½d. per 1000 feet per candle. It is provided by the Act that these extensive powers are not to be exercised without the concurrence of at least two of the three gas referees.

The appointment of Dr. Letheby as "chief gas examiner" is a well-merited recognition of his pre-eminence as a gas analyst and of his thorough impartiality. The principal duties of his office will be to examine the reports of the gas examiners, and to act as umpire in any disputes. The report of the results of the testings in each day are to be delivered on the day following to the Corporation, to the chief gas examiner, and to the companies, and if any company think themselves aggrieved by the report of a gas examiner they may appeal to the chief examiner, whose decision is to be final. At the end of every quarter he is to make a report to the Corporation and to the companies of the results of the daily testings of that quarter, stating the illuminating power and the amount of impurity on each day. It will be his duty also to determine whether any defect of illuminating power or

excess of impurity was occasioned by an unavoidable cause or accident. The appointment of Dr. Letheby as chief gas examiner, of course, renders vacant his office of gas analyst to the Corporation, and they will have to appoint one or more gas examiners at the several places prescribed by the gas referees, in accordance with the provisions of the new Act. Their duties will be to test the gas supplied by the three companies in the manner and at the times prescribed by the gas referees, and to make daily reports of the results of the testings. At the meeting of the City Court of Sewers on Tuesday last, the necessity for the appointment of a successor or successors to Dr. Letheby was mentioned, and the consideration of the subject was referred to the Streets Committee.

Mr. Charles Henry Parkes, a partner until the end of the last session of Parliament in the eminent firm of Messrs. Dyson and Co., parliamentary agents, has been appointed auditor of the accounts of the gas companies. The duties will be to investigate as soon as practicable the accounts of the three companies which supply the City with gas, to ascertain the amount of their capitals, distinguishing share from loan capital, and also to ascertain how much of the capital of the Chartered Company ought fairly to be apportioned to their district within the City. The auditor is to prescribe a form of accounts to be kept by the companies, to audit their accounts half yearly, and if in any instance he finds them incorrect in principle or detail, the company are to correct them in such manner as he thinks right, and no dividend is to be declared until the accounts are certified by the auditor. The companies are required to give the auditor and his clerks access to the books and documents, and to afford them all facilities for the execution of their duties. If the companies, or any of them, think themselves aggrieved by the determination of the auditor, the matter in difference is to be referred to an arbitrator.

The remuneration of the gas referees, of the chief gas examiner, and of the auditor, is to be determined by the Board of Trade, and the amount, including all expenses properly incurred, is to be paid by the gas companies in proportion to the amounts of their paid-up capitals applicable to the City. The remuneration of the gas examiners, and all expenses incurred by them, are to be paid by the Commissioners of Sewers.

The machinery for carrying into effect the City of London Gas Act by gas referees, a chief gas examiner, gas examiners, and an auditor of accounts, will no doubt be somewhat costly, and other expenses will most probably be incurred after the experimental year of 1870, should the price of 3s. 9d. per 1000 feet for 16-candle gas be revised at the wish either of the gas companies or of the Corporation. The Act provides that in January, 1871, or in any subsequent year, if application be made to the Board of Trade by any company or by the Corporation for a revision of the scales of illuminating power and price, three competent and impartial persons are to be appointed by the Board as commissioners for the purpose. The commissioners are to fix such an illuminating power and price as shall be calculated to yield to the companies, with due care and management, and taking into account any saving that might be effected by their amalgamation, a dividend attaining as near as may be, but in no case exceeding, the rate of 10 per cent., and to make up an insurance-fund against accidents of 1 per cent. The illuminating power is in no case to be less than 12 candles, nor the price higher than 4s. 6d., as fixed by the Metropolis Gas Act. The costs of the revision, if it be applied for by the companies, are, in case they fail to obtain any alteration, to be paid by them out of the sum applicable to dividends, but, if they be successful in obtaining a reduction in the illuminating power or an increase in the price of gas, the costs are to be chargeable to ordinary expense of management. If the application for an alteration proceed from the Corporation, they are to pay the costs in the event of failure, and, if successful, the costs are to be paid by the companies out of the funds applicable to dividends. Power is, however, given to the Corporation and to the gas companies to agree to an alteration of price and illuminating power without application of the Board of Trade, by which means the heavy expenditure that would otherwise be incurred might be saved.

Register of New Patents.

3318.—Peter Salmon, of 6, Great Smith Street, Westminster, in the co. of Middlesex, engineer, for "*Improvements in the manufacture of gas, and in the treatment and application of such and other gases for cooking, warming, lighting, generating of steam, and other purposes combined with their use as a motive power previous to being burned or consumed, and improvements in the apparatus for these purposes.*" Patent dated Nov. 23, 1867.

This invention has for its object the manufacture or production of gas from spirit, oil, tar, or other fatty matter of strong generating power, so as to render the same useful for raising of steam, warming, cooking, and other purposes, also for giving a clear bright light for illuminating or lighting, and as a motive power when used in the manner hereafter mentioned in the apparatus hereafter described, that is, so as to actuate the pistons of power engines, or as a substitute for steam previous to its being burned for any of the preceding or other purposes; and consists, firstly, in generating gas from any of the above liquids in a closed vessel by jets of steam direct or steam surface heat (superheated preferred), or by fire heat or flames from gas or oil, either applied externally to the vessel itself, or to coils of pipe, or tubes or ducts inserted in the interior thereof, the improvements being in the mode or method of fitting the tubes in the interior of said vessels or generators (being screwed into the one plate with back jam nut, the other end with screwed ferrule, then both ends riveted, and the whole galvanized if approved), which vessels or gas generators may be made of any shape or form, either combined with a steam-boiler or used separately, and are fitted with self-acting supply and shut-off valves, stop-cocks, pressure and level glass gauges, feed injectors, purifiers, scrubbers, and driers, and when once set to work will continue to work with little attendance. The self-acting shut-off valves consist of a barrel or cylinder, which it is preferred to make in brass, of the dimensions of 12 inches long and 1 inch in diameter (internal measure), and in this barrel or cylinder a piston and piston-rod are fitted, the former encircled with an india-rubber ring, and the latter passing through the cover of the barrel or cylinder, the other end diminishing to a quarter-inch tube, screwed at the smaller end for screwing into the gas generator; and the action is effected by the gas entering by this small tube and pressing on the other side of the piston, the upper side of the piston being acted on by a circular spiral spring of the desired strength for the pressure required, thus moving the piston-rod in or out as the pressure of gas rises or falls in the generator, which rod by a pivot acts on a common stop-cock, and shuts off or opens the passage of the pipes through which the steam passes to generate the gas. The feed injectors which it is preferred to use are what are commonly known as Gifford's injectors, used in steam-boilers and actuated by the steam, the only difference when used for the purposes of this invention being that the action upon them is by gas for injecting the spirit, oil, tar, or other fatty matter into the gas generator. The novel scrubbers are vessels (through which the gases pass) filled with sponge, tan, asbestos, or charcoal, the liquid therefrom being drawn off by a tube. The novel driers are also vessels (through which the gas passes), to which is applied fire heat or flames from gas or oil, in order to improve the quality of the gas.

Secondly, the invention consists in the application of gas manufactured as hereinbefore described, or any other gas, for lighting, cooking, warming, generating of steam, or other purposes, by means of the suitable apparatus and treatment hereafter described, that is, by the heat of the flame or flames of gas being expended or applied to the burners, holders, or conveyance-pipes from which the lights or flames are supplied for the purpose of evaporating any liquid contained therein produced by the condensation of the gas, thereby increasing its illuminating, warming, and generating power. In its particular use in generating steam in boilers, there are four different modes or methods of application which may be applied to boilers or generators of steam of all descriptions, whether locomotive, marine, portable, or stationary, each style or description of boiler requiring the distribution-pipes to be suitably fitted; the first of these is as follows:—The liquid is placed in a cistern to which a supply-pipe is fitted, through which the liquid is conveyed to any of the interior parts, surfaces, or tubes of the boiler in drops, when it is instantly evaporated into gas by the heat of the steam-boiler, and consumed in generating steam, to which a jet or jets of steam (superheated preferred) may be introduced to prevent smoke and promote combustion. Second, a light fire of coal, charcoal, wood, or other combustible material is placed in the furnace or fire-box, supported by fire-bricks or iron plates, and the liquid dropped thereon, evaporated thereby, and soon consumed, to which jets of steam may be introduced to prevent smoke and promote combustion. Third, the liquid is evaporated into gas in a separate closed vessel or generator by fire heat or flames from gas or oil, and conveyed in pipes, and consumed in the external or internal surface of the boiler itself, or the tubes or cones fitted in the interior thereof, or any or all of these combined, and jets of steam (superheated preferred) mixed with the gas previous to its being burned. And in the fourth, the liquid is evaporated into gas in a separate closed vessel or generator by steam surface heat (superheated preferred), either applied to the vessel itself or to coils or tubes of pipe fitted in the interior thereof, or any or all of these combined, and jets of steam (superheated preferred), either applied to the vessel itself, or to coils or tubes of pipes fitted in the interior thereof, and jets of steam mixed with the gas, and distributed in the same manner as that described as the third mode or method. The requisite amount of atmospheric air to sustain and promote combustion may either be forced in by force-pump and tubes or admitted by suitable apertures or perforations. The gas manufactured in the manner above described, or in any of the modes described, in closed vessels, or gas generated or manufactured in any other way, or from other liquids or substances in closed vessels, may be used as a substitute for steam previous to its being burned or consumed in generating steam in boilers, or lighting, cooking, warming, or other purposes. This use of the gas can be applied to engines of all descriptions, whether locomotive, marine, portable, or stationary, and may be made to actuate the piston of a separate cylinder in a steam-engine, or to one side only of the piston, the other being actuated by steam. In all high-pressure engines, whether locomotive, marine, portable, or stationary, the heat of the exhaust steam (when the said

steam is used separately and distinctly from the gas either by separate cylinders or to one side of the pistons of these) may be utilized in generating or evaporating the gas by the surface heat thereof being applied to the gas generators as described, but in condensing engines a jet or jets of steam from the boiler is required to evaporate the gas. As there is lubrication in the gas when two cylinders are in an engine, such as locomotives, the piston of the one being propelled by gas and the other by steam, the pipes may be arranged so that they can supply gas or steam at pleasure for change, or the one side of each of both pistons may be actuated by gas and the other by steam.

Thirdly. Another mode or method and means or apparatus for operating is for the whole of the steam used as a motive power to be conveyed by a pipe and passed through the spirit, oil, tar, or other fatty matter contained in the gas generator, then used as a motive power previous to its being consumed or burned in raising steam in the boiler, the heat of the burned gases being applied to a superheater through which the steam passes before entering the gas generator containing the spirit, oil, tar, or other fatty matter; or this mode may be reversed, that is to say, the steam from the boiler in the first instance is used as a motive power, then superheated and passed through the spirit, oil, tar, or other fatty matter, thereby producing gas to be consumed in generating the steam in the boiler; but it is considered that the former mode will show by far the best result, not to speak of the increased duration of the cylinders and pistons from lubrication.

3333.—Thomas Chalmers, of the city of Glasgow, now residing in the city of New York, U.S.A., for "*Improvements in machinery for producing seamless tubes.*" A communication. (Complete specification.) Patent dated Nov. 25, 1867.

The details of this invention would be unintelligible apart from the drawings attached to the specification.

3397.—John Joseph Parkes, of London Street, Paddington, in the co. of Middlesex, gas engineer, for "*Improvements in the means of ventilating rooms and buildings, and in apparatus for the same.*" Patent dated Nov. 29, 1867.

These improvements are chiefly applicable to such houses or buildings as are provided with a circulation of hot water. In carrying out the invention a tube or series of tubes is enclosed in a casing forming an air space, and placed above the chamber to be ventilated, the said tube or series of tubes being heated by the hot water circulating through them. The casing is placed in communication with the chamber to be ventilated by means of a tube terminating in a grating placed in the wall of the chamber. The upper end of the outer casing is connected with a pipe leading out into the open air, where it is surmounted by a cowl. The rarefaction of the air surrounding the heated tube or tubes, and contained in the outer casing, causes the air to ascend and escape into the atmosphere by means of the pipe and cowl above mentioned, thus forming a partial vacuum in the pipe below the heated tubes, the air in the chamber being drawn off through the grating to supply its place; thus effecting a continual ventilation of the chamber, so long as the tubes are kept heated.

3404.—Samuel Edward Tyrrell Steane, of Barking, in the co. of Essex, soap manufacturer, for "*Improvements in globes and glasses for the transmission of artificial and other light.*" Provisional protection only obtained. Dated Nov. 30, 1867.

These improvements consist in constructing the globe of a double thickness of glass, presenting a convex form both on the outside and inside, and having a hollow space between to contain water or other liquid or fluid for increasing, by its refractive and reflective power, the light encircled by the said globe.

3415.—Edward Price, engineer and manager of the Hampton Court Gas Company's Works, Hampton Wick, in the co. of Middlesex, for "*Improvements in apparatus for regulating the supply of gas to burners.*" Patent dated Dec. 2, 1867.

This invention relates to the employment and construction of such apparatus as will prevent the necessity for daily lighting and extinguishing the public lamps by hand, but although specially designed for public lamp use it is by no means limited thereto, as it is equally applicable to lamps in any situation where a small but continuous though hidden flame during daylight is not objectionable.

The apparatus may be constructed of various forms, but the principle of its action is the same; that is to say, that as the pressure of gas is increased during the lighting hours, a bell, holder, or flexible diaphragm is acted upon, and communicates motion to a cock or valve, which is opened thereby and the gas allowed to pass to the burner, which, when the apparatus is at rest, emits but just enough gas to keep an almost imperceptible flame alight, but when in action allows an ample quantity to give an efficient light. Or the apparatus may be so arranged that when it is out of action the flame may be entirely extinguished at the ordinary burner, but as soon as it is put in motion may be relighted through the intervention of a small supplemental though hidden jet which is kept constantly burning. On the other hand, when the pressure in the mains is decreased, as during daylight, so also is the flame at the burner decreased or entirely extinguished, according to the construction of the apparatus; in the latter case, however, sufficient gas is allowed to pass to the independent jet to keep it always alight.

One of the forms of apparatus may be described as follows:—A small instrument somewhat similar in construction to an ordinary public lamp governor, but having an inlet only in communication with the vertical lamp service-pipe, is placed either within or without the lantern. This instrument may be like either a wet or dry governor; that is to say, it may consist of a bell or holder working in some kind of liquid, or it may be made with a flexible diaphragm. In either case the bell or diaphragm carries with it a vertical rod, which is connected by a lever to the tap or valve through which the burner is supplied with gas. The rod is also connected with another lever, which operates upon a guard or protector to the small flame when not in use as an illuminator.

Another modification, and one that may be preferred, is described as follows:—A cylindrical or other suitably shaped case, made of tin plate or other material adapted for the purpose, is screwed on to the service-pipe or cone. Within this chamber a ring of metal rises, to the upper part of which is attached a flexible diaphragm. In the centre of this diaphragm a rod is fixed, which carries a little valve fitting into a seal. On the exterior of the case two tubes are attached, one being in communication with the chamber beneath the diaphragm, while the other is in connexion with that part of the apparatus which lies immediately below the valve; and when the instrument is not in action and the valve closed all communication from one tube to the other is cut off. What may be termed the "permanent leak"—that is to say, the quantity of gas which is allowed to pass to the little supplemental jet—is determined by the size of orifice in the jet. A guard is attached to the burner cone, and surrounds the jet flame to protect it from the wind. It is proposed that one of Sugg's patent public light governors should be used in conjunction with this apparatus, as it is an extremely useful accessory for regulating the quantity consumed by the ordinary burner. It is, however, by no means indispensable for the proper working of this invention. In lieu of the bat's-wing or fishtail burner, it is intended that an Argand should be used wherever it can be employed without objection, a better light being produced thereby, while it affords more security against any outward disturbance to the jet flame, which is in this case carried up through the central orifice of the burner.

The action of the apparatus is as follows:—The jet is first lighted during the daytime, and the diaphragm weighted, so that the valve may remain closed at the maximum day pressure. As the time for lighting up approaches an increase of pressure in the mains becomes necessary. This pressure causes the diaphragm to rise and open the valve, when the gas flows to and escapes at the burner, where it is immediately ignited by the jet. On the other hand, when the time for extinguishing draws near the pressure in the mains is reduced, the diaphragm consequently falls, the valve closes, and the light is put out.

The claim is for the construction of apparatus whereby the pressure of the gas is made available for lighting, extinguishing, and regulating the supply of gas to burners substantially as described.

3430.—John Hays Wilson, of the firm of John Hays Wilson and Co., of Liverpool, in the co. of Lancaster, brassfounders and ships ironmongers, for "*Improvements applicable to water-closets and pumps connected therewith, which latter improvements are applicable to lift-pumps generally.*" Patent dated Dec. 3, 1867.

This invention consists first, in constructing closet pans or basins of glass. Second, forming the same at the lower end with a shank or hollow faucet, having a lateral opening or aperture therein for discharging the contents thereof, substantially for the purpose and in the manner described and set forth. Third, turning the closet-pan on its vertical axis for discharging its contents. Fourth, constructing closet-pans so that they may be removed or lifted from their seats. Fifth, forming the rotating pan-neck or seat of the rotating pan with recesses to receive tallow or other lubricating material. Lastly, the general arrangement and combination of the several parts described and set forth as applied to ships and other water-closets.

3457.—William Anthony Herring, of Chertsey, in the co. of Surrey, engineer and ironfounder, for "*Improvements in apparatus for warming buildings in which high-pressure steam-engines are employed.*" Patent dated Dec. 4, 1867.

According to this invention the exhaust steam from the engine is caused to pass a coil of pipe of such diameter that the back pressure on the engine may be insignificant. This coil is enclosed in a cistern or closed tank with which pipes for warming the building are connected. The outlet-pipe passes away from the top of the cistern or tank, then circulates through the rooms or buildings to be warmed, in the ordinary way of a hot water apparatus, and afterwards the pipe returns the same water in a comparatively cold state to the bottom of the cistern or tank. This water remains in the cistern or tank until it again becomes hot, and then it again circulates through the pipes of the hot water apparatus. In this way the rooms or buildings are warmed without other fuel than that necessary to keep the high-pressure steam-engine at work, and at the same time an economy of water is effected, which sometimes is of importance, the exhaust steam from the engine being condensed into a pure water which is returned into the boiler.

3466.—Arthur Charles Sterry, of Woodgate Cottage, Ewell, in the co. of Surrey, for "*Improvements in engines worked by heated air or gas.*" Provisional protection only obtained. Dated Dec. 5, 1867.

This invention has for its object the production of motive power by means of air or gas alternately heated and cooled in separate chambers, and always maintained at a pressure greater than that of the atmosphere, thereby admitting of an engine being driven by air or gas at a lower temperature than when the air or gas is admitted to the compressing pump at the atmospheric pressure, less heat being generated in this pump at the same pressure.

3474.—Cornelius Kerby, of St. Dunstan's Hill, in the City of London, for "*Improvements in the combination of materials to be used for filtering liquids.*" Provisional protection only obtained. Dated Dec. 6, 1867.

This invention consists in the combination of certain materials for the filtration of liquids, and by the employment of which that operation can be performed with great efficiency. A sheet of linen, calico, or any other textile or felted material possessing the requisite degree of strength and porosity or permeability, is covered with a layer of paper pulp, such as that which of ordinary filtering-paper is manufactured, there being no size mixed therewith. Adhesion between the pulp

and the fabric is obtained by subjecting the sheet or fabric so coated as before mentioned to the pressure of a hot roller. For the filtration of water containing organic impurities, charcoal in a pulverized state may be combined with the paper pulp, and in like manner other substances which are capable of acting upon the liquid or liquids under treatment, according to well-known chemical principles, may be beneficially combined with the pulp.

3491.—Charles Mathew Barker, of 12, Kennington Park Road, in the co. of Surrey, engineer, for "*Improvements in socket and flange spigot-pipes.*" Patent dated Dec. 7, 1867.

This invention relates to certain improvements in socket and flange spigot-pipes, for the conveyance of gas and water, whereby leakage at the joints and connexions is prevented, and the pipes are joined together and also disconnected more quickly and economically than by the methods at present in use.

According to this invention the pipes are cast with a male thread on the spigot, which is also made with a flange or bevelled collar and taper end, whilst the socket is cast with a female thread, and corresponding taper cavities, so that the two can be screwed tightly together with liquid Portland or red lead cements, or soft lead, pitch, or similar materials, placed between the threads and surfaces, and tightly compressed between such surfaces, which from their configuration securely hold the cement; and, as the taper end of the spigot fits the taper cavity of the socket, and the bevelled collar or flange fits the taper recess of the socket's mouth, the joints are thereby closely sealed, and any leakage prevented. Gas and water pipes having a liability to be disturbed by traffic passing over them, or from settlement of the earth, leakage is consequent thereon, which by the joints above referred to is prevented, as these pipes must be turned partly round to allow of any space by which leakage could occur, whilst the tensile strength of the pipe is operative against deflection, giving rigidity to the joint, and obviating the evil to which all ordinary pipes are liable, as they by any deflection have their spigots partially drawn from their sockets, and continual leakage is resultant. For the prevention of leakage in making connexions for services, these pipes have cast on them flat-sided or hexagonal bands, one of which is situate at the root of the cup or socket, and the others at equal distances along the pipe, the service-connexions being made through the flat surfaces of these hexagonal bands, in place of through the cylindrical surface of the pipe; a better joint is thus effected, as the flat surfaces of the hexagonal bands afford sufficient material for a continuous thread therein, consequently giving extra strength to the screw of the service-pipe, and presenting a flat seating to the check-nut for securing the service-joint from leakage. In cases where a T-pipe is to be introduced for an extension of main, the same may be readily accomplished by removing one of the 9-feet pipes, and inserting in its place short lengths of pipe, say 3 feet each, on one of which the T is cast. These short pipes are provided with deeper sockets and longer spigots, for the purpose of facilitating the insertion of the said pipes, without disturbing those originally laid. The first of the three short pipes has two sockets, one of ordinary length, to be attached to the pipes already laid, and the other of extra length to receive the spigot of the next or T piece, on the straight length of which two spigots of extra length are cast, as well as a socket on the transverse of the T, which last socket is of the ordinary length, to receive the spigot of the extension-pipe; the third short pipe has a long socket at one end, and an ordinary sized spigot at the other end, to be screwed into the socket of the old laid pipe. Now, the pipe first named being screwed on to the spigot of the old laid pipe, the T-pipe is next screwed home into the long socket of the first short length of pipe; and, the spigot of the third pipe having been screwed into the socket of the opposite pipe of the old laid main, the T-piece that had been previously screwed home in the long socket of the first pipe is unscrewed until it enters the long socket of the third pipe, and thus completes the junction of the main. The joints are sealed by cast-iron back-nuts, with flat or bevelled flanges screwing up with cement, and sealing the joints at the taper surfaces made on the nuts and in the cavities in the mouth of the sockets, thus coupling and sealing both ends of the pipes newly inserted with those of the old pipes.

The claims are—

1. The combination of screwed flange spigots and their flat or taper sealing surfaces with internal screwed sockets and their corresponding taper cavities, for the purpose of making tight joints in gas and water pipes, by enclosing and compressing any cement, soft lead, or other equivalent material, between the junction surfaces, substantially as hereinbefore described.

2. The use of hexagonal or flat-sided bands, cast on the pipes for the purpose of presenting flat surfaces, which, together with back or check nuts, effectually provide for screwing in service-pipes without danger of leakage, substantially as hereinbefore described.

3501.—Henry Bessemer, of Queen Street Place, Cannon Street, in the City of London, for "*Improvements in the manufacture of fire-bricks, tiles, and solid or hollow fire-lumps, and in the manufacture of retorts, pipes, crucibles, or other hollow vessels or moulds required to resist a high degree of heat, and also in the manufacture of ornamental bricks, tiles, quarries, trusses, bosses, vases, busts, figures, columns, capitals, bases, cornices, copings, tablets, finials, and other articles of an ornamental character employed in building and in architectural decorations.*" Patent dated Dec. 9, 1867.

The object of this invention is the production of various articles in clay, or in such mixtures of clay with other substances as are commonly employed in the manufacture of fire-bricks and in terra-cotta and other pottery, in such manner that little or no shrinking or distortion of the article shall take place during its manufacture, while the time occupied in its production is considerably reduced. For this purpose clay (or a mixture of clay with other materials) is employed which has previously been subjected to a red heat, and has thereby to a great extent lost its plastic qualities and power of shrinking; the burnt clay so employed may, however, in some cases, be mixed with a small portion of plastic clay in a dry and powdered state, by preference not exceeding one-sixth to one-tenth the weight of the burnt clay used in conjunction therewith.

In the manufacture of fire-bricks and like articles it is preferred to use the old broken fire-bricks or bats that have previously been employed in constructing furnaces, or in lieu thereof lumps of raw fire-clay are burnt, either in kilns or in open heaps in the way generally employed in burning "ballast." The burnt lumps of clay, or broken bricks, or pottery, are crushed in any suitable crushing-machine, the more perfect pulverizing or granulating of the materials being effected between rollers or under edge-runners, after which the material is to be separated into various degrees of fineness (by sieves or otherwise) suitable for producing the particular grain or quality desired in the various articles to be manufactured therefrom. The fine granular burnt clay thus prepared is put into a pug-mill or mixing cylinder, and as much silicate of soda or potash, having the consistency of thick treacle, is added thereto as will, when mixed with the dry clay, reduce the same to a sticky or moist condition somewhat resembling Muscavado sugar; the admixture of the silicate will be facilitated if the clay powder be previously moistened with a little water. The mixture thus formed of fluid silicate and granulated clay should be well and evenly rammed into every part of the mould by a suitable rammer, or it may be forced therein by a press; in either case, sufficient pressure should be employed to render the object moulded sufficiently firm to bear its removal from the mould without injury. The moulds may be made of metal, plaster of Paris, or wood, and the moulded article, when taken from the mould (or sometimes while retained there), is to be sprinkled and well soaked with a saturated solution of chloride of calcium or other soluble salt containing a base which will combine with the silica and form an insoluble compound; and, if necessary, the moulded article may be boiled in such solution, and after it is completely saturated with the chloride of calcium it should by preference be allowed to remain in a dry place for twelve or twenty-four hours, in order that the gelatinous silicate of lime formed in the interstices between the grains of burnt clay may harden and cement the whole firmly together, after which the chloride of sodium formed by the chemical action and union of the silicate of soda and chloride of calcium may be removed by the solvent action of a plentiful supply of fresh water allowed to fall on to it like a heavy shower of rain for a period of twelve to thirty-six hours, depending on the thickness and porosity of the article, after which the drying may take place in open sheds or in a drying-room.

3503.—Cornelius Kerby, of St. Dunstan's Hill, in the City of London, for "*Improved apparatus for filtering liquids.*" Provisional protection only obtained. Dated Dec. 10, 1867.

This apparatus, in its simplest form, consists of a receptacle or chamber of a square or other convenient shape, and constructed of wood lined with metal, or of any material or materials suitable to be employed for the treatment of any particular kind of liquid. In the upper part of the receptacle or chamber is placed a frame fitted with a network of galvanized iron-wire, or of other suitable material, on which the filtering substance is placed, or the support for the same may consist of a perforated diaphragm or tray of porcelain or glass, or other material calculated to resist any corrosive or chemical action of the liquid submitted to the process of filtration. The filtering medium which, by preference, is employed in conjunction with this apparatus consists of a sheet of linen, calico, or any other textile or felted material possessing the requisite degree of strength and porosity or permeability, the same being covered with a layer of unsized paper pulp, with which may be combined charcoal or other substances capable of acting chemically upon the liquid under treatment. A self-acting float, or ball-cock, or valve, is fitted at the upper part of the receptacle or chamber above the filtering-tray, by which the liquid is admitted, an exit pipe and cock being fitted at the lower part of the receptacle or chamber for the withdrawal of the filtered liquid. The apparatus as thus described in its simplest form can be combined so as to form a series of filtering-chambers one above another, which may be separately removable. In this case a main supply pipe is placed at one end of the compound apparatus, which pipe communicates with each receptacle or chamber, the inlet of liquid into those receptacles or chambers which are already supplied therewith being prevented by the action of the self-acting cocks or valves. At the opposite side of the apparatus is fixed a main exit-pipe and cock, such pipe being capable of being placed in communication with each receptacle or chamber by means of flexible tubes, which can be attached or removed at pleasure.

APPLICATIONS FOR LETTERS PATENT.

2666.—John Tule, of Glasgow, in the co. of Lanark, N.B., engineer, for "*Improvements in arrangements and apparatus for dealing with sewage.*" Aug. 28, 1868.

2667.—William Strang, of Glasgow, in the co. of Lanark, N.B., for "*Improvements in arrangements and apparatus for dealing with sewage.*" Aug. 28, 1868.

2699.—Frederic Hudson, of 227, Blackfriars Road, in the co. of Surrey, manufacturer of gas-meters, for "*Improving dry gas or liquid meters.*" Sept. 1, 1868.

2700.—William Cartwright Holmes, of 56, Gracechurch Street, in the City of London, engineer, for "*Improvements in apparatus used in the manufacture of gas.*" A communication. Sept. 1, 1868.

2727.—Thomas Butterworth, of 18, Mumps, Oldham, in the co. of Lancaster, engineer, for "*An improved pump suitable for lubricating and for other purposes.*" Sept. 4, 1868.

2732.—Joseph Sproul, of Salisbury Villa, Hadley, in the co. of Middlesex, for "*An improved system of water power.*" Sept. 4, 1868.

2745.—William Tatlock, of Frankfort, Germany, civil engineer, and Christopher Nicolay Abelseth, of Philadelphia, Pennsylvania, U.S.A., civil engineer, both now of 8, Southampton Buildings, Chan-

cery Lane, in the co. of Middlesex, for "*Improvements in apparatus for manufacturing gas.*" A communication. Sept. 5, 1868.

2752.—GEORGE DAVIES, of 1, Serle Street, Lincoln's Inn, in the co. of Middlesex, and 87, St. Vincent Street, in the city of Glasgow, civil engineer, for "*An improved meter for water or other incompressible fluid.*" A communication. Sept. 7, 1868.

2759.—CHARLES HOLLAND, of Chicago, in the co. of Cook and state of Illinois, U.S.A., gentleman, for "*Improved compositions for the production of artificial stones, tiles, and pipes, and useful also as cements, paints, and for stuccoes.*" A communication. (Complete specification.) Sept. 7, 1868.

2780.—ALFRED VINCENT NEWTON, of 66, Chancery Lane, in the co. of Middlesex, mechanical draughtsman, for "*An improvement in pumps.*" A communication. Sept. 9, 1868.

GRANTS OF PROVISIONAL PROTECTION.

2445.—CLAUDE FRANÇOIS CONSTANT CRETIN, of Glasgow, in the co. of Lanark, N.B., for "*Improvements in lamps for burning gases or oils.*" Aug. 4, 1868.

2563.—BENJAMIN PRYOR STOCKMAN, of 23, Abingdon Street, Westminster, in the co. of Middlesex, civil engineer, for "*Improvements in water-meters.*" Aug. 17, 1868.

2583.—WILLIAM THOMSON, of Glasgow, in the co. of Lanark, N.B., for "*Improvements in tools or apparatus for expanding and cutting tubes or metallic rings, part of which improvements is applicable for withdrawing ferrules from the ends of boiler-tubes.*" Aug. 18, 1868.

2608.—THOMAS WEBSTER RAMMELL, of 3, Westminster Chambers, Westminster, in the co. of Middlesex, civil engineer, for "*Improvements in rotary or centrifugal machines for acting upon air, water, and other fluids, and communicating motive power thereby.*" Aug. 21, 1868.

2651.—WILLIAM HALL, of Wilford Street, in the town and co. of the town of Nottingham, for "*Improvements in rotary engines to be worked by steam or other fluid, and which are also applicable to be used in raising or forcing fluids.*" Aug. 26, 1868.

2667.—WILLIAM STRANG, of Glasgow, in the co. of Lanark, N.B., for "*Improvements in arrangements and apparatus for dealing with sewage.*" Aug. 28, 1868.

INVENTION PROTECTED FOR SIX MONTHS BY THE DEPOSIT OF A COMPLETE SPECIFICATION.

2759.—CHARLES HOLLAND, of Chicago, in the co. of Cook and state of Illinois, U.S.A., gentleman, for "*Improved compositions for the production of artificial stones, tiles, and pipes, and useful also as cements, paints, and for stuccoes.*" A communication. Sept. 7, 1868.

NOTICES TO PROCEED.

1283.—WILLIAM MALAM, of Old Kent Road, in the co. of Surrey, gas engineer, for "*Improvements in the manufacture of gas, and in apparatus employed in such manufacture, part of the invention being also applicable to the manufacture of retorts, retort-casings, crucibles, and melting-pots for various useful purposes.*" April 20, 1868.

1317.—HENRY HILL, of the town and co. of the town of Nottingham, brassfounder and general manufacturer, for "*Improvements in water-closets, and in ball and other cocks, taps, and valves.*" April 22, 1868.

1393.—GION BAPTISTE BABACCI, of Florence, in the kingdom of Italy, for "*Improvements in gas-engines.*" April 29, 1868.

1423.—JOSEPH LILLIE, of the city of Manchester, engineer, for "*Improvements in apparatus for regulating, measuring, and registering the flow of liquids.*" May 1, 1868.

1428.—JOHN WARNE, of the Blackfriars Road, in the co. of Surrey, pewterer and beer-engine manufacturer, for "*A new or improved union-junction or fastening for pipes and tubes.*" May 1, 1868.

1430.—PAUL MARLIN and AUGUSTE TACK, of Brussels, in the kingdom of Belgium, civil engineers, for "*An improved process for transforming hydrocarbon oils into gas for illuminating and heating purposes.*" May 1, 1868.

1444.—WILLIAM ROBERT LAKE, of 8, Southampton Buildings, Chancery Lane, in the co. of Middlesex, consulting engineer, for "*An improved mode of and apparatus for generating gas and mixing the same with atmospheric air for heating and illuminating purposes.*" A communication. May 2, 1868.

2398.—JOHN GWYNNE and HENRY ANDERSON GWYNNE, of the Hammersmith Iron-Works, Hammersmith, in the co. of Middlesex, engineers, for "*Improvements in the construction of and mode of employing and driving centrifugal pumps and pumping-engines, and in surface condensers to be employed in conjunction therewith, parts of which improvements are applicable to other purposes.*" July 30, 1868.

Parliamentary Intelligence.

HOUSE OF COMMONS.

DERBY WATER-WORKS BILL.

(*Continued from page 656.*)

FRIDAY, MAY 29.

Mr. *Bagshawe*, examined by Mr. SOMERSET.

I am the manager of Letton Mills, below Buxton, on the Wye. The drainage from our mills is collected in a tank, and then carted on to the land for agricultural purposes. The refuse from the gas-works is also collected in the same manner, and carted away.

The COMMITTEE thought it was not worth while to go to places above Matlock.

Mr. *John Wheatcroft*, examined by Mr. SOMERSET.

I am a surveyor, and engineer to the local board of Matlock. I consider that the Derwent is much better now, with respect to its purity, than it was years ago. I have drunk the water many times.

Cross-examined by Mr. RODWELL: When our scheme is carried out, the sewage of the town will be used for agricultural purposes. I think that, from the great distance which sewage matter has to go down the river before it reaches Derby, it is quite neutralized, and rendered perfectly pure. The refuse from some of the mills runs into the river, but from others it sinks into the gravel. The ammoniacal liquor from the gas-works, which is not sold, may go into the river. There are works in which a large quantity of vitriol is used, which drain into the Derwent. The water in which diseased people bathe at Matlock is collected in a deodorizing-tank. There are brooks into which refuse is emptied, and they run into the river.

Re-examined by Mr. SOMERSET: Our works are at a distance of 14 miles from the water-works. The brooks to which I have alluded are a mile and a half further off. I consider that the water which the company supply is excellent. No better can be obtained anywhere.

By the COMMITTEE: If the penalty of £200, which is to be imposed upon the managers of gas-works who discharge refuse into a river, was to be inflicted in this case, it might have the effect of stopping the works altogether.

Mr. RODWELL said that the penalty could not be imposed unless the works were under Act of Parliament.

Witness said they were a limited liability company.

Mr. *Hopkins*, examined by Mr. SOMERSET.

I am an auctioneer and surveyor at Belper. I should say that very little sewage now goes down the main sewer into the river. Messrs. Strutt take great precautions to prevent the river being fouled, and I know that those precautions have been effectual. Ashes and rubbish are thrown into the privies, and the refuse is carted away and purchased by farmers. The Derwent is very much purer now than what it was ten years ago. The population of Belper is diminishing. I believe the water of the Derwent to be better than that of any river in the ten counties. There are plenty of fish in the river, and as low down as Milford. We could not very well increase our supply from the springs.

Mr. *Peter Soutar*, examined by Mr. SOMERSET.

I live near Duffield Bridge, and am the surveyor of highways. I get my water from a well which is sunk to the depth of four yards in the gravel. The water from the river percolates into the well, and it is good in quality. When the river is low I find no difference in the water from my well.

Cross-examined by Mr. RODWELL: Duffield is supplied with water in various ways, both by pumps and wells. It would be a good thing if the village was supplied by the water company. I saw the main drain opened, and it was black in places with filth.

Re-examined by Mr. SOMERSET: It was silt in the drain, not filth. It was sand and grit, and nothing else.

Mr. *Bromley*, examined by Mr. SOMERSET.

I am a land agent and surveyor at Derby. A very great change has been effected in the supply of water to the town by the present company. I consider that the water is very good for all purposes. I have examined the works of the company, and the source from which they obtain their supply. The water in the river is quite as good as it was ten years ago. I agree with the other witnesses in thinking that the watershed of the Derwent and the whole circumstances of the river are very favourable to the purity of the water. I cannot perceive any difference in the water now from what it was 30 or 40 years ago.

Mr. *D. Hoskins*, examined by Mr. SOMERSET.

I am a surgeon now living at Duffield. I previously resided at Derby. The population of Duffield is about 1600 or 1700, and they are badly supplied with water. It is derived principally from Wells. There are only 33 pumps, as far as I am aware. The water generally is exceedingly hard, and in some instances it is discoloured from its being impregnated with iron. The inhabitants have to go long distances to get to the pumps. It would be a great boon to be supplied by the water-works company. The water from the Derwent has always been good, and I have never heard any complaints respecting it. I am the surgeon to a large union of thirteen parishes. The Derwent appears to be much better than it used to be, and great care is now being taken with regard to refuse going into it. My house is supplied by a well; but the water is bad, having a fœtid, brackish taste.

Cross-examined by Mr. RODWELL: I send for water from the well belonging to Mr. Soutar. I cannot account for the bad smell from the water in my own well. I do not know that it is Derwent water filtered through gravel. I think it comes from the Ecclesburne. The waste of good water is very much felt in Duffield, and I think it would be a great advantage if the village could be supplied by the company. There have been no formal arrangements entered into by the Duffield people about taking a certain quantity of water, but I know they are very anxious to have it. I have heard many of them say, "Give us the chance, and we will take the water." I think that, in a sanitary point of view, it would be a great boon, and would be the means of checking cases of fever to which the people are liable at different times.

Mr. *Henry Evans*, examined by Mr. SOMERSET.

I am a director of the company, and live at Darley, where I have works. Our men get their water from wells. I never heard of any complaints as to the water which the company supply at Derby. I can speak of the great pains which Messrs. Strutt take with reference to the river. When it is in flood the water is less discoloured than it used to be. I know the wells in Derby. We have one 14 or 15 feet from the river, which gives particularly good water, and it is not altered whether the river rises or falls.

Cross-examined by Mr. BIDDER: The river below the town is not fit for consumption, owing to the sewage matter that goes into it. The company's water would be very useful to the inhabitants of Darley, but I cannot say there is a very strong opinion on the subject. The company made up their minds to come to Parliament in the autumn. The immediate cause was that we had spent more than our capital. We want larger works and more capital. We consulted Mr. Hawksley before any steps were taken. We considered whether there were any new springs we could take, and we found we could not do better than follow the advice our engineer gave us.

Mr. *A. Parkinson*, examined by Mr. VENABLES.

I am the secretary to the company, and was the accountant for two years previously to my appointment. [The witness gave the number of houses supplied by the company under £10 assessment.] There are many small houses in Derby which we do not supply, but which we would supply if we were applied to. When our new works are constructed we shall be able to give as much water as the inhabitants may require. I was formerly clerk to Messrs. Strutt, and can speak to the means which they adopt for keeping the river pure.

Cross-examined by Mr. BIDDER: I do not know the number of houses that are not supplied. I am not aware that any applications have been made to the directors for water to be put on, and nothing has been done. We have not been charging our maximum rates at all. We want more filtering power, various extensions in the town, and more capital as a matter of course.

Mr. *Richard Baylis*, examined by Mr. SOMERSET.

I am a surveyor at Spondon, which place is badly supplied with water. There are groups of houses with draw wells. I have been a member of the Sanitary Committee of the corporation, and I never heard of any complaint of the water supplied by the company.

Cross-examined by Mr. BIDDER: There is an advantage in the works being in the hands of the company, instead of the corporation. If they were in the hands of the company they would have absolute power. Being retained by the company, I think the consumer has two advantages—he need not take the water unless he chooses to do so, and if he does not get what he requires, then he has the corporation, whose duty it is to protect him. I think that Spondon should be supplied by the company. I think we could find £200 a year, but it is impossible for me to say. The village is situated at a considerable elevation above the town of Derby. I constructed the Belper Water-Works. The supply there is from springs; I did not take my supply from the Derwent because I had nothing to do with the application to Parliament. Another engineer was at first employed. After the bill was obtained some disputes took place, and then I was appointed engineer to the company, and I carried out the works, being restricted to certain reservoirs and certain localities. I was not responsible for the idea. Had I been consulted with regard to Belper, I should have taken powers certainly to pump from the river.

The COMMITTEE thought they had heard sufficient as to the supply of Belper.

Mr. *Burrow*, examined by Mr. SOMERSET.

I am a surgeon at Derby, and have practised there for a great number of years. I remember the old and insufficient supply, and my attention was called to the bad effect of the water on the health of the people. I remember having my attention called to the state of a well during a time of cholera, and my opinion was that nothing could be worse than it was. I think the supply given by the company has been quite satisfactory. Comparing the state of health of the town, both before and after the company began its supply, I should say that it is decidedly better. There is less fever and diarrhœa now than formerly. I never heard of any complaints as to the quality of the water. I know the village of Normanton; the supply is principally from wells, and the water is very hard and insufficient in quantity. Some of the wells are near to the churchyard, and the people object to drinking the water from them. It would be absurd to think of getting water from the river below Derby. It certainly would be of advantage to the inhabitants of Spondon to be supplied by the company.

Cross-examined by Mr. BIDDER: I cannot say that the death-rate has decreased in Derby during the last 10 or 12 years. A great deal, of course, with regard to the improvement of health, may be attributed to the drainage of the town. I do not know that the death-rate since 1861 has been exactly the same as it was in the previous decade from 1850 to 1860.

Mr. BIDDER said that he could prove this by the Registrar-General's returns. As far as a better supply of water went, it did not seem to have had much to do with the death-rate of Derby.

Witness said that great numbers of the poor were still unsupplied by the company, and were dependent on wells.

Re-examined by Mr. SOMERSET: I believe it would be a great advantage for the company to supply Normanton with water. It is not within the borough of Derby, and therefore it could not be supplied with any benefit by the corporation, neither would the parish of Litchurch benefit by such an alteration.

Mr. *G. Newdegate*, examined by Mr. SOMERSET.

I am a justice of the peace for the county of Derby, and have property at Normanton. I lately lived at Litchurch. I am anxious that the company should supply water to Normanton. I have asked them to do so, and their reply was that they had no power to do it. I know that the water which the company supply to Derby is excellent.

Mr. *S. Whitaker*, examined by Mr. SOMERSET.

I own a considerable quantity of house property in Derby. My tenants are perfectly satisfied with the water which they get from the company. I have property also at Littleover, and I know it would be a great boon if the company could extend their mains to that locality, as also to Normanton.

Mr. *J. Lindley*, examined by Mr. SOMERSET.

I am a surgeon, and have practised at Litchurch for 10, and at Derby for 35 years. I am a member of the Litchurch Local Board of Health, and may say that we approve of this bill entirely, and I believe that the people of Derby generally are perfectly satisfied with the supply which they get. As a rule, a great number of the wells in Derby are unwholesome.

Mr. *H. Good*, examined by Mr. SOMERSET.

I am a doctor of medicine, practising at Derby. I agree with the other witnesses as to the quality of the water, and I think it will be a good thing if this bill is allowed to pass.

Mr. *W. Lowe*, examined by Mr. SOMERSET.

I am a dyer, living in Derby. We use the river water for dyeing, but when the river is flooded, we have our supply from the company.

Cross-examined by Mr. BIDDER: The thickness of the water in flood time arises from the sand brought down by the current, and not from any impregnation by sewage. If it was filtered, of course it would be clear and free from sand, like that which is supplied by the company.

Mr. *J. H. Gascoigne*, examined by Mr. SOMERSET.

I am a silk manufacturer of Derby. The supply now given by the company is regular, and the water very excellent in quality. I consider it absolutely necessary that further powers should be given to the company. I have recently erected an additional manufactory, and I wish it to be supplied by the company, in preference to my having water from wells. I was present at the town's meeting, when the proposition for the corporation to take the works was negatived by a "forest of hands." I should be surprised if another meeting of the kind was held after such a declaration on the part of the inhabitants.

Cross-examined by Mr. RODWELL: There were a variety of opinions urged at the meeting. It might have been said that the corporation would have a large sum to pay for the works. At Manchester, it was said the corporation were losing £20,000 a year by taking the water-works into their own hands.

Sidney Crossley, Esq., examined by Mr. SOMERSET.

I am a civil engineer, and engineer to the Midland Railway Company. I resided at Litchurch for eight years. My property at Derby was formerly supplied by wells. I found the water very bad and discoloured, and in consequence I had the water of the company laid on. Now we have a good and plentiful supply. I have examined the water of the Derwent in various places, and have also searched the valley for the springs which the corporation allude to in their petition, but without success. Bottle Brook is excluded from the supply of the company. My opinion is that the Derwent is very good water, but it should be remembered that it is not taken by the company direct from the river, but that it is filtered before it is supplied to the public. It is filtered first naturally, and then artificially. The scheme will be of great advantage to Derby.

Cross-examined by Mr. BIDDER: I do not believe in the theory that the six millionth part of a grain of sewage will kill any one. It is much more economical to pump water at 1d. per 1000 gallons than to have it from wells. I think the water taken from the tunnels is mostly spring water, and not so much comes from the Derwent as may be supposed.

MONDAY, JUNE 8.

Mr. *John Cooper*, of Derby, gave evidence as to the quality of the water supplied by the company. He also deposed to what took place at the town's meeting. In answer to Mr. RODWELL, the witness said that he preferred the spring to the Derwent water because it was cooler, and not because it was more fresh or had more bubbles at the bottom of the glass.

Mr. *M. J. Tempest*, of Duffield, had used the water for 16 years, and never heard any complaints.

Mr. *C. H. Turner*, a magistrate residing at Litchurch, expressed a very favourable opinion as to the Derby water.

Mr. *J. Genever*, assistant overseer of Litchurch, corroborated, and gave some statistical information as to the number of houses in Derby, the population, the rateable value, &c.

Mr. *J. Shaw*, examined by Mr. SOMERSET.

I am a surveyor of Derby. I produce plans of the river, showing the streams and works between Matlock and Derby. The Matlock Gas-Works are 18 miles above the company's works. The gas tar is collected in a tank 170 yards from the Derwent. There is another gas-work—the New Matlock Gas Consumers Company—a little nearer Derby. There is no escape of refuse from those works. [The witness was examined as to various works, drains, and outfalls, but his evidence went to show that the water was clear the whole way down. By the scheme Mr. Shaw said that new filter-tunnels were to be laid down—62 chains upwards and 80 downwards.]

Mr. *Hawksley*, further examined by the COMMITTEE.

The filter-beds are 15 to 20 yards from the river. Supposing that the river was in an impure state, and the water was constantly filtered through a filter-bed, the filter would only become impregnated with such impurities as were capable of being destroyed by oxygen. [Witness drew a sketch of a filter-bed.] In the process of going from the river, water goes at an exceedingly small rate—indeed, so slowly that they never got more than from half a gallon to a gallon per minute for every yard into that tunnel. In that way all the oxidizable matters became oxidized, and they got nothing but pure water or water in the same condition as spring water. They saw no difference in the filtration now to what it was 18 years ago. They proposed to carry the filter up the river on one side, and to lay a pipe across the river, and carry it up on the other side. If those two did not supply water enough, then they proposed to extend their filter-tunnel down the other side of the river as much as might be necessary.

Mr. *R. Eastwood*, of the Victoria Railway Iron-Works, Litchurch, said that his firm used 15,978,000 gallons of water a year, paying about £200 for it, and they found that greater incrustation took place in their boilers when they used spring water than what it did when they took the water of the company. There is an instrument called the "Gifford Injector," which is a modern invention, and it makes it very convenient for supplying water to steam-boilers; consequently, the water-works water that is brought to the door along the streets in pipes is a very complete and convenient way of getting it—very much superseding the old way of pumping it out of wells, and forcing it into the boilers by force-pumps. At Messrs. Fletcher's works the water is very bad. They have a boiler the plates of which were completely eaten through into holes in about 18 months, and this arose from using well water.

Mr. *M. Loam*, examined by Mr. SOMERSET.

I am the resident engineer of the water-works at Nottingham and Derby. I have superintended the Derby works for about 15 years. There are 12 directors, who by this bill are to be reduced to seven. We supplied last year 375 million gallons, or rather more than a million gallons a day. There is no more spring water of consequence to be obtained close to the works. We have two large engines, either of which can pump the water which is required in 24 hours, and we have three filter-beds, two of which can do the work when the third is being cleaned.

Cross-examined by Mr. RODWELL: At Nottingham we get good water from the Trent. It was increased a few years ago by water from the sandstone, which is a purer water. It is a matter of expense, and in this the Derwent water is cheaper than the water from the springs. I think there is nothing that would contaminate the Derwent or prevent it from being used by the company.

By the COMMITTEE: The filter-tunnel is brickwork laid in the water-bearing strata. It is laid through the water-works, and leads through the open brickwork and passes along. It is precisely similar to a well, only it is horizontal instead of being vertical. It is about 10 feet deep in the gravel.

W. Haywood, Esq., examined by Mr. SOMERSET.

I am a civil engineer, and have given great attention to the question of water supply to towns. I have inspected the Derby works and the river. I believe it to be very excellent water. I am the engineer to the corporation of London, and I advise them on all questions affecting the public health.

Cross-examined by Mr. RODWELL: I have constructed a water-work upon a large estate in Berkshire. I have never managed any works. The waters from a great many wells in the City of London have been interdicted, but whether upon sufficient grounds is a question. It is perfectly certain that exactly the same waters have been drunk for generations by people without any harm accruing to them from so drinking. I know that they were condemned at the time when the public were very susceptible and alarmed, about anything, in fact, connected with the water supply. They did contain, many of them, large quantities of nitrates; but I never heard it stated that the nitrate which they contained was in itself an unwholesome thing, it was simply saltpetre. There is no doubt that many of the bright waters are charged with injurious matters. I was reared upon the water from one of those objectionable pumps, and it did not harm me.

James Simpson, Esq., examined by Mr. SOMERSET.

I am a civil engineer, and have had forty years experience in water-works. I have constructed many of them. I am engineer to the Chelsea and the Lambeth Water Companies. I have examined the watershed of the Derwent. It is a large one, with a comparatively small population. The river is not polluted to anything like the extent it is in other districts. It is a very good water indeed. The water is diffused through all the porous parts of the banks into the filter-tunnels. It is a mistake to suppose that it would come to one point; wherever there is porous and free soil under the river it will go from one side to the other; in fact, it is a question of the point of depression—wherever you depress it you will have water. I think that the river water at Derby is the better of the two.

Cross-examined by Mr. RODWELL: I should say beware of spring water, as you do not know what the contamination is.

Professor *Ansted*, examined by Mr. VENABLES.

I have paid great attention to the question of water supply. I have ex-

amined the district of the Derwent and its watershed. I find there are about 155,000 acres running over the millstone grit, about 65,000 acres over the mountain limestone, and about 30,000 acres over coal measures. The limestone grit is, perhaps, the best source for water; the limestone is remarkable for producing pure water, which is not always exceedingly hard. [Witness spoke to the gauging and estimates of the water which passed from different places in the Derwent.] Generally speaking, I find the river a pure stream. The population is sparse, and the result of sewage contamination from a population distributed as that is would be that it was entirely lost, passing from one peopled place to another, by the simple process of oxidation. If a large quantity of sewage went into the stream of the Derwent, the immediate result would be a very small fraction of a grain per gallon when it was exposed to the whole body of the water; it would be entirely oxidized in a very short distance. A large quantity of sewage is oxidized in seven miles, but a small quantity is lost long before that. I have made a calculation, supposing that half the sewage of the population came down, as to how much there would be, leaving out the oxidation, of pollution in a gallon, and I think I made it out to be about 1-20th of a grain in some places, and in others as much as 1-30th. That would be decidedly inappreciable in estimating water as a material to be used for domestic purposes; or for manufactures. Water should be clear to the sight, unobjectionable in taste, and giving a good result by analysis; then it is impossible that it should be otherwise than wholesome. I think the greater part of the water in the filter-tunnels does not come from the river. There are not any more available surface springs that I could see. There are six gas-works on the river and its tributaries. The refuse, of course, ought to be removed economically; it ought not to be wasted, if there is no necessity for the nuisance. If the sewage of the whole population of 30,000 passed into the river, it would not produce above the eighth of a grain, if it was all concentrated in one town, and placed pretty close to the works. But the nearest large population is some miles off, and the sewage does not pass into the river at all. Notwithstanding all these things I consider that it is a wholesome and advantageous supply.

Cross-examined by Mr. RODWELL: I do not imagine that all these streams running into the Derwent will make a difference of the 100th of a grain per gallon in the water that passes into the works. I am of opinion that unless the poison or the offensive matter can be detected by analysis the water is innocuous, I should say that if water is in a state in which no impurity can be detected by sight, or smell, or chemical analysis, such water is perfectly fit for human use in any way whatever. Some persons may hold different opinions. I think it impossible, considering the distance it travels, that any injury can be done to the Derwent by sewage contamination. I should consider one grain of sewage matter in a gallon objectionable. There is a difference between a grain and one-eighth of a grain, and the difference is between disease and health. I do not think that the objection to water altogether depends upon the amount of sewage matter that is contained in it, because water might have arsenic in it.

Re-examined by Mr. VENABLES: A grain of sewage matter oxidized in a gallon of water would be as innocuous as a pebble. It is burnt out; it ceases to be sewage after a short distance. In some cases most offensive water becomes purified by similar exposure.

TUESDAY, JUNE 9.

Mr. *J. Shaw* produced returns of the number of houses, and the rateable value of the parishes proposed to be added under the bill. The population in 1861 was 11,107, the number of houses in the same year 2422, and the rateable value £77,338 12s.

Dr. *Henry Letheby*, examined by Mr. VENABLES.

I am professor of chemistry at the London Hospital, and medical officer of health for the City of London. I have paid particular attention to the water supply for at least 25 years. I have examined the supply of Derby. The river was in flood at the time (7th of March), and the total quantity of solid matter in the water was 11·27 grains. Last week (4th of June) I found the river opposite the works to contain 17 grains in one gallon. The quantity of nitrogen existing as nitrates and nitrites was very small—it was ·045 of a grain. The nitrogen as ammonia, which is the test of purifying matter, was still smaller; it was ·002 of a grain. This is less than the London waters. I estimated the quantity of oxygen that was required to oxidize the organic and other matters, and it amounted to a little more than the tenth of a grain; it was ·161. As a rule, it is about one-eighth of the organic matter. I have frequently examined the Derwent water for the oxygen, and I never found less than ten times the quantity of oxygen in the water that was required for the oxidation of the organic matter. The degree of hardness before boiling was 13—nearly the same as in the Thames water supplied to London. The permanent hardness after boiling for a quarter of an hour ranges from 3 to 4½ grains. I have taken samples from the service-reservoir on three occasions. On the 7th of March the total solid matter was 21·59 grains per gallons; on the 19th of May it was 17·05 grains; and on the 4th of June it was 17½ grains per gallon. The nitrogen, as nitrates, amounted to ·105 of a grain per gallon; as ammonia, ·001 gallon. The quantity of oxygen required to oxidize the organic matter was ·024 of a grain per gallon, and the hardness was 13½°—being nearly the same as in the filter-tunnel—and this was after the water had been mixed with the spring water. I think that a good deal of spring water which cannot be seen comes into the filter-tunnel. My analysis agrees pretty substantially with that made by Dr. Odling, and I have no hesitation in saying that the water is a very good water for a town supply. I think a rather hard water, with from 10° to 12° of hardness, is best suited for domestic purposes and the real wants of the human body than a soft water; but a soft is more useful for the other purposes. I do not know that I have ever seen such beautiful water as there was in the service-reservoir; 10 feet down I could see the impression of a sixpence as clearly as if it were in the open air. I do not think that the gravel or silt would be injuriously charged with impure matter by the water passing through it. I am cognizant with the works of large towns, and have visited over and over again the filtering operations of the metropolis, and I know that the impurity upon the filter sand does not reach half an inch below the surface, and the scour of the first flood would clear it off. It would last as a filter, as regards the sub-surface material, for ever, I believe. Then, as to sewage, I can state as the result of a very large experience, that sewage running into a stream in the proportion of one part of sewage to 20 of the stream, and going seven or eight miles down the stream, is completely destroyed. It is oxidized; it is used by vegetation: it is precipitated. It is used by animalculæ, by vegitation, and by fish in the stream. There is no other way of ascertaining the purity of water except by the use of the senses, assisted by chemical analysis. It is not possible that water can be injurious if it satisfies the eye, the taste, and the smell, and if chemical analysis shows that there is an absence of organic matter. As to a source being proper or improper, we must be guided by the particular circumstances of the case. In this case I found the water in the filter-channel quite as good as the water in service-reservoir, where it has been mixed with the spring water; and I do not think that the alteration as proposed in those two sources would injuriously affect the supply.

Cross-examined by Mr. BIDDER: As a rule, water into which sewage matter has run, after flowing seven or eight miles, would be fit for the purpose of supplying a population. That is my opinion, conditionally that the analysis of the water furnishes evidence of its goodness. I should not allow my proposition alone to guide me. It is so as a rule. River water is equal to spring water, with this exception, that it does not contain so much carbonic acid as spring water. Spring waters are always rather brisker to the palate, by reason of the carbonic acid which they contain. The reason that people prefer the water of a well is because the water is brisk and sparkling. The character of some well water in the neighbourhood of cesspools and churchyards arises, in fact, from the presence of carbonic acid, and sometimes from the decomposition of sewage matters; but when it is decomposed into carbonic acid and nitrates, you must lose sight of it as sewage. Sewage is a frightening word to use under those circumstances; it is just as if I were to apply it to bread, because the nitrogen in bread has come out of the manure from which the corn has grown. Sewage would be an alarming word to use in that case.

Re-examined by Mr. VENABLES: I have a mode of testing for organic matter. I examine the water through a glass tube, two feet in length, and in proportion to the organic matter is the brownish tint of the water. In this particular case the water from the service-reservoir is blue, and there is no perceptible quantity of organic matter to the eye. It was the finest water I have ever seen.

Dr. *William Odling*, examined by Mr. SOMERSET.

I am lecturer on chemistry at St. Bartholomew's Hospital, a Fellow of the Royal Society and College of Physicians, and I have had considerable experience in the analysis of water. I have analyzed the water of the Derwent, and I agree with Dr. Letheby. I found, on the 9th of May, in the river opposite the works, 15·70 grains of solid residue per gallon, and 74 grains of combustible or volatile matter. The hardness was 11°, and the permanent hardness 3½°. The springs contained 14·51 grains of solid residue; 1·45 combustible or volatile matter; hardness, 12·2°; permanent hardness, 5°. As far as it goes, the river water is somewhat better. In the service-reservoir the results were, 17·68 grains of solid residue; ·70 combustible matter; 19·63 nitrogen as nitrates; and ·18 nitrogen as ammonia. The water as supplied is unexceptionably excellent. I am satisfied that the scheme for taking a very large additional quantity of water from the Derwent will be in no way injurious to the population of the town.

Cross-examined by Mr. BIDDER: With regard to the modes of estimating previous sewage contamination, I may say that I dissent altogether from the opinion published by Dr. Frankland on that subject; but, taking his opinion as the basis, the amount of sewage contamination in spring water is very considerably greater than in river water. As a matter of feeling, if I could get water which had had no animal contamination at any time, I would give the preference to that water over water which, at some time or other, had been mixed up with some animal contamination, even although it did not contain it now. So far as I know, the amount of contamination from the drainage of cultivated land found in springs is equal to, if it does not exceed, that which is found in river water. I believe that the water of the Derwent might be used without the filter-tunnels.

This was the case on behalf of the promoters.

The COMMITTEE, in answer to Mr. BIDDER, said they were satisfied, from the board having claimed the option to purchase the works, that they were satisfied with the quality of the water.

Mr. BIDDER said their reason for wanting to purchase the works was to improve the quality of the water. The learned counsel then proceeded to call witnesses against the bill.

Mr. *J. Parkin*, examined by Mr. BIDDER.

I am a surveyor and land agent at Idridgehay, near Worksworth. I have examined the Derwent, with a view of ascertaining the number and nature of the tributaries that flow into it. [Witness spoke to the offensive matter which flowed into the river from the works at various places.] Refuse from the Matlock Gas-Works flows into the river. The sewage of the hydropathic establishment at Matlock Bank and other places finds its way into the river. I should not like to drink the water of the Derwent below Matlock. No doubt a good supply could be got from the springs within a distance of ten miles from the works.

Cross-examined by Mr. VENABLES: I have given notice to the gas-works to abate the nuisance. They are liable to a penalty of £200.

B. Latham, Esq., examined by Mr. RODWELL.

I am a civil engineer, and the president of an association of civil engineers in Westminster Chambers. I have had considerable experience in matters relating to the construction of water-works. I believe that where sewage has been poured into water any amount or process of filtration will not remove the taint so as to make the water wholesome. Although to the eye and nose, and even to chemical analysis, noxious matters may not be perceptible, it is quite possible that the water may still retain some impure water. I inspected the Derwent for the corporation, and I found offensive matter running into it at various places, and on the same side as the works of the company. I infer from this that the water on that side of the river was very much more impure than it was in the main body of the stream—that is to say, they did not get the benefit of the diluting power of the entire stream. The water was discoloured, and changed to violet, green, and purple. This was at Belper. I found there were about 40 mill-dams upon the Derwent and its tributaries, throughout the entire watershed. They are very injurious, because they lead to the stagnation of the water, I am the engineer to the Town Council of Warwick. The water for the supply of that town is taken above the junction of the river from Leamington. It receives, at a distance of 13½ miles above the town, the sewage of Coventry, and from an analysis which has taken place we find that year by year the impurities of the river are increasing; and it shows that the agents by which the natural purification is effected are becoming less active. At Warwick the general effects of the drainage in the town have produced a marked diminution in the rate of mortality from all causes. Fever has been reduced about 52 per cent., but one disease which I have found more attributable to impure water is diarrhœa. That disease, since the water has been taken from the river to supply Warwick, has increased at the rate of 40 per cent.; I therefore say it will be very unwise to take the water from the Derwent. You generally find, as a rule, that the most impure water is the most deceptive. I think that filter-tunnels are extremely uncertain, both as to the quantity of water they are to yield and the quality. We generally find, in the artificial filters, that the matter that is removed by filters of this description is a merely mechanical matter, and that it passes into the filter at various depths, greater or less, according as

the impurities are of greater or smaller size. In examining an artificial filter you generally find that there is a stain perceptible to the eye some 5 or 6 inches into the body of the sand. The ordinary course of proceeding is that a few inches are removed to clean the filter, but that only suffices for the purpose of removing the mere crude matter; it does not effectually clean the filter, because, after some four or five years, you find it necessary to remove the whole of the sand from the artificial filter and wash it, or supply fresh material. All these matters would in a natural filter go on accumulating, and it is impossible that they can, in the nature of circumstances, be removed by the ordinary surface removal. The interstices in the filter would after a time become filled with a deposit. At the old Glasgow Water-Works filters of this description were used, and abandoned because it was found that they ceased entirely to effect purification. When the filters became choked the water took a particular channel—forced a channel for itself in a particular direction—so that the water passed through this natural filter without any filtration, and the complaints were very great indeed. In point of fact, the best filter is the bad substitute for bad water. I think that Derby should be supplied by the rainfall collected on the surface. I should say that such a supply could be readily obtained. At Ely, in 1862, where I was the resident engineer, there was an outbreak of a serious character in the shape of diarrhœa. It was traced entirely to the stoppage of a drain in a private house near the water-works, the sewage running back into the overflow, which communicated with this drain where the filter-beds of the water-works are. The quantity of sewage was in the proportion of about 1 in 1000. I think that where the water-works are under the control of the local authority it is more easy to carry out sanitary matters, and in dealing with the lower class of houses, than where they are in the hands of a company.

Cross-examined by Mr. VENABLES: At Warwick the quantity of organic matter in it was a grain or more per gallon. There are in it a large amount of nitrates and chlorides, which have increased of late years. I should say there are 330 million gallons a day running in the Derwent. [Witness read the analysis of the Warwick water taken by Dr. Playfair in 1852.] I think the water of the Avon is preferable to the Derwent. If sewage is received into the river, or into the bank of the river immediately above the works, and there is no means by which it can be removed, that sewage contamination must contaminate the water of Derby. Bottle Brook seems to be nothing but a stream of sewage. I think that purification is effected by the bed of the river, and not by the oxygen at all; but the time will come when the bed of the river will cease to have that effect. I admit that if you once receive sewage into a river you can never make it a matter of certainty whether the water is wholesome or not. You may make a chemical analysis to-day, and find the water pure, and yet you may have an outbreak of disease next day, and you do not know to what to attribute it. I remember the case at Croydon, where the water, after a few miles flow, killed the fish to a large extent. This was the case until the sewage was taken out of the river and applied to the land. They spent £3000 or £4000 a year in attempting to purify it by chemical processes, and the more they tried to purify the worse the water got. I do not think there will be any adequate return for the improvement of the water supply in Derby. I consider that the filter-tunnels in time will be useless, as the impure water will accumulate in the interstices of the gravel bed. The water in the river is of better quality itself than after it has passed through the filtering-tunnels. Where you have got a filter of this description, you find, when the foul matter has been accumulated in the substratum of the soil, that the effect of the filtration of pure water through a foul medium will be to render the water more impure.

Mr. *T. W. Latham*, grazier at Little Eaton, spoke to the contamination of the Bottle Brook. Cattle had refused to drink of the water.

E. S. Gisborne, Esq., examined by Mr. BIDDER.

I am an engineer and surveyor in Derby. I have examined the Derwent, and in my judgment the matter brought in from various points is sufficient seriously to contaminate the water of the river. I do not say it is an absolutely undrinkable water if there were nothing else. The river is decidedly getting worse.

Cross-examined by Mr. VENABLES: I have used the water from the company, and I never heard any complaint about the quality of it.

G. Thompson, Esq., examined by Mr. RODWELL.

I am a borough surveyor at Derby. The Derwent is much discoloured in places. I believe that the natural filtration as proposed by the company will ditch it up in time. I have noticed on the banks of the river, after a large flood, a black slimy mud. I have found a great deal of trouble with the men who are employed by the company in cutting up the roads; the grips which they cut have been of considerable expense to us. If the water was in the hands of the local board, a more liberal use would be made of it than there is now. The urinals in Derby are quite unsupplied, and more water is required for the fish-market and other places.

Cross-examined by Mr. SOMERSET: We could now have a more liberal supply of water for sanitary purposes if we paid for it.

WEDNESDAY, JUNE 10.

Mr. *E. Thompson*, builder, of Derby, said that the Derwent was the natural drainage for Matlock, Crawford, Belper, Milford, Makney, and Duffield. Had seen cattle standing in the river at every shallow. Believed that filtering-beds would not take out the impurities of the water.

Mr. *T. Madeley*, an alderman of Derby, and chairman of the committee to conduct the opposition to the bill, said that the object was to get a better water at a cheaper rate. They were not satisfied with the river water, owing to its great pollution. They did not so much desire to purchase as that they should have the best water that could be got. They believed that spring water could be obtained from the gritstone formation. There was a repugnance to drinking water which had sewage contamination in it. Was convinced there was good water to be got from wells in the town; still the corporation did not want to rely upon that. It seemed ridiculous that the company should be going to the expense of £30,000 or £40,000 for filter-tunnels, when their own analysts had told them that they could get better water out of the river. Did not believe that the villages required any additional supply. The expense of taking it there would never pay the company. The witness spoke of the hardness of the Derwent water, and the incrustation which it left in pipes used at his works. Complaints as to the quality were frequently made to the turncocks and the collectors, who had not been examined. It would be an advantage if the works were sold to the corporation at a fairly remunerative price.

Mr. *T. Roe*, the mayor of Derby, gave similar testimony.

Mr. *S. W. Fearn*, surgeon, of Derby, believed there was a mortality now in that town of 200 or 300 a year, in consequence of the water supply coming from the river. He thought it was not safe to trust merely to an analysis of the quantity of salts or detectable matters in water. Chemistry might do a good deal, but not everything. Chemists could not detect poisonous matters which produced fever and cholera and various infectious disorders. Had seen the water in the Derwent look muddy and not very drinkable.

Dr. *G. Taylor*, of Derby, deposed to the difficulty that existed of compelling people in small houses to take the water and to get the expenses by the county court process. Thought the mortality would be less if the water was of a better character.

Mr. *J. Owen*, a member of the corporation, considered that the company had not behaved liberally in the supply of water for sanitary purposes.

Dr. *A. J. Bernays*, examined by Mr. RODWELL.

I am a professor of chemistry at St. Thomas's Hospital. I formerly resided at Derby. The water of the Derwent is of a considerably fluctuating nature, arising from the fact that the rainfall is at times upon the limestone and at times upon the gritstone, and in consequence that alters the quality of the water, especially with regard to the carbonate of lime in it; and then, again, there are springs which I cannot quite understand; but there are many springs which come in very likely from the limestone, and which open up at Derby, which seem to mix with the water, and very seriously to alter the quality of it. The quantity of organic matter differs according to the season. I do not agree with the statement altogether that if water is sweet to the taste and to the smell, and is good upon analysis, there can be no noxious matter contained in it to make it unwholesome or prejudicial to health. In the first place, we have no test for organic matter as to its injurious quality. It is extremely probable and possible for a water to indicate a small amount of organic matter, and yet that matter shall be of the most injurious character. It is impossible for analysts to discover the presence of organic germs in water, and inasmuch as the most injurious constituents of sewage are those which are not soluble in water, that substance may be carried for many miles, and be ripened into an injurious condition by temperature and so forth. During a cholera visitation, or a season in which diarrhœa is prevalent, that would be more liable to develop itself. Sewage and sewage may be as different as light and darkness from one another.

Mr. RODWELL: Mr. Hawksley has stated here—and he is rather bold sometimes in his assertions—that there are no men of note and no school who uphold the theory, that sewage can remain in water without being detected by analysis, or something to that effect. You do not agree with him, as I understand?

Witness: Of course, it is very possible for a person to hold nobody to be of any note but himself; that, of course, is a matter of opinion; but there are some who do not believe, at least, that sewage is capable of entire removal when it has once been introduced into a water, and there are many, such as myself, though not a noted man, who profess to be amongst the number. There is a very large school, and a very increasing one too. I happened to be at Lay, a town on the Moselle, at a time when the inhabitants were being decimated by cholera, and I found that they drank of springs which ran through the churchyard. It was a most beautiful water to look at, and sweet to the smell and the taste. As to water being pure, which has had sewage in it, after it has passed a certain distance, I do not consider it to be a recognized fact. I should be sorry to say what would be the distance. I know, for a fact, that a water after it has appeared to have lost the power of being acted upon, for instance, by permanganate of potassium, if it be left to itself for about two days in a well-stoppered bottom it will again have the power of deodorizing a portion of that fluid, and inasmuch as that is the case it is clear that there is still organic matter capable of being oxidized and acted upon. I would only take the water of the Derwent from necessity, and nothing else; but, barring the sewage, I think it is a very fine water. It seems that a great deal more may be ascertained about the quantity of organic matter in water by further tests. I do not look to the quantity of organic matter contained in the water alone as a necessary or the only test, for a water may contain a considerable quantity of what I may call inert organic matter. I would not drink water which contains oxidized sewage a grain in a gallon. Of course, there are certain ingredients which can be thus oxidized and become quite inoffensive. I have no doubt, if you were to take out certain sulphides and the sulphuretted hydrogen in the water, with the run and flow of the Derwent, you would have them oxidized at the distance which has been mentioned, and it is possible that their smell would be entirely annihilated, and their injurious properties destroyed; but I am hardly prepared to say that with regard to some of the more harmful and difficult matter connected with germs and with vegetation. I am not one of those who believe that if nitrogen is present, but converted into nitrates, therefore all the nitrogen in the organic body is destroyed. I say there are organic bodies which do the mischief which are more than germs. When one reads about nitrates in water they are very often a sign of mischief done instead of mischief doing.

The witness was cross-examined at some length by Mr. VENABLES, in which he said that he had analyzed the water of the south side of London for the last three or four years, and the state of it was such that he never drank it himself. He believed that both the Lambeth and Vauxhall Companies got their supply from the same place.

Dr. *E. Frankland*, examined by Mr. RODWELL.

I am a professor of chemistry in the Royal Institution, and also lecturer in the Royal School of Mines. I have analyzed two samples of the Derby water. [The witness gave the analyses. It seemed that, in respect to the first, the previous sewage contamination was 1·168; permanent hardness, 8·68; temporary hardness, 4·18; and the total solid impurity per gallon was 18·2. The second sample was a better water, though somewhat harder.] I consider that a water which shows a considerable proportion of previous sewage contamination ought not to be used for domestic purposes if there is any other available supply. Sewage is known to contain that which is noxious to life, and its noxious quality cannot be detected by chemical analysis even in the fresh sewage itself. It consists of germs of organisms which, on account of their vitality, are much less easily oxidized and destroyed when mixed with a large volume of water than the other constituents of sewage. Those germs, however, are present in such a very small quantity, even in fresh sewage, that no one has succeeded in detecting them as such. Sometimes they are so indestructible that they do not yield to boiling water; even for a period of four hours they have been known still to retain their vitality. One of those germs, although present in 1 million gallons of water, might be received by some water-drinkers in a single tumbler of that water. I have intentionally contaminated water with cholera poison, or suspended rice water, as it is called, and it could not be removed from the water by filtration. I would say that water which still retains sewage detectable by analysis—sewage in a considerable quantity—will not only be pleasant to look at, but palatable to the taste. [Sample of such water produced from a well in Albemarle Street.] This water is a very favourite water. It is used by the domestics of the Royal Institution in preference to the London water supplied there;

and in the cholera year—1866—I placed the pump under prohibition. I prohibited the use of this water, and I have been repeatedly since petitioned to remove this prohibition from the water, which, however, I have not done. This water is little more than filtered from the sewage going along Albemarle Street into this shallow well. It contained, according to my then analysis, 43,240 parts of previous sewage contamination in 100,000 parts; and it contained of actual contamination with unoxidized sewage 4½ per cent.—that is, a half-pint glass of this water contains nearly a quarter of a pint of water which had previously been in the condition of London sewage. Besides, the glass of water would contain a dessert-spoonful of actual unoxidized sewage. The water is very palatable to drink; it possesses the refreshing taste of nitrates in water, and any one would drink it without hesitation.

By the CHAIRMAN: I am not aware that it has produced any bad effect upon those who have drunk of it.

In answer to Mr. RODWELL, *witness* said that he did not think sewage was always unwholesome; it was only during the prevalence of epidemic disease. He believed that the only safe rule to be laid down about water for drinking purposes was that, if it had once been contaminated by sewage, it ought never afterwards to be used for such purposes. He would object to water on the ground of hardness, but of course to a less degree.

Cross-examined by Mr. VENABLES: I have no doubt there is a little nitrogen in a peach, but it is not from the manure in which it is grown. It indicates the ammonia which has been in the plant. There is nitrogen in wheat, which comes partly from the air, but to a great extent from the manure which is used in growing the wheat. It is not a monstrously imprudent thing to eat bread. There is a comparison between the two cases. Those germs or organisms cannot enter into the circulation of the plant. I have seen one of those germs with a microscope. I made a report last year to the Registrar-General about the water of the Kent Company at Bromley, and said that it was undesirable to use it for domestic purposes.

Dr. *Augustus Voelcker*, examined by Mr. RODWELL.

I am the analytical chemist of the Royal Agricultural Society of England. I certainly prefer, under all circumstances, spring water to the best river water, however little sewage may have been introduced into the river, because, being generally considered extremely injurious to health, I should rather be without it if I could lay my hand upon something better. It is extremely difficult to get rid of impurities in water completely. I am not prepared to say that it actually leads to serious results, but it is the generally accepted opinion. It is a fact that noxious matter may be and is very often not destroyed either by dilution or by boiling, as described by Dr. Frankland. There is extreme uncertainty as to the destruction of prejudicial organic matter in water.

Cross-examined by Mr. VENABLES: I have a predilection for soda water.

Re-examined by Mr. RODWELL: There may be nitrogen in water. If it is present as nitric acid, or as nitrites, or even as ammonia, it may not do harm.

THURSDAY, JUNE 11.

Mr. *E. Barnett*, brewer, of Derby, said that, in consequence of the impure state of the water during the summer of 1865, they were obliged, instead of cleaning out their coppers once a week, to clean them out four or five times. It affected their brewing, as they were obliged to reduce the quantity of barm used in fermenting 33 per cent. The water either had fermenting qualities of its own, or it had something in it which conduced to fermentation. The water is now very hard; there is an enormous amount of incrustation and scale arising from it.

In answer to Mr. VENABLES, *witness* said that the company's water was very fair for brewing. He was not there to find any fault with it.

Mr. *W. E. Burrows*, a manufacture of soda water and aërated water at Derby, said that the company's water was not so good as it formerly was. It had been very turbid, and frequently came through the meters green, and likewise there was a sediment in it, which he could conpare to nothing else than pickings of flannel or shoddy, or something of that kind.

Mr. *F. Vessey*, engineer of the Derby Corporation Baths, said that complaints had been made by bathers as to the condition of the water.

Mr. *S. H. Mason*, a varnish manufacturer, considered that the river water was unfit for drinking purposes.

Mr. *Jones*, clerk to the Local Board of Health, said that the board had laboured under great disadvantage frequently in consequence of not having the water-works under their control. There was not the power of making owners of property take a supply at a sum not exceeding 2d. a week. [The witness was examined as to the death-rate of Derby, and official returns were handed in.]

W. T. Coz, Esq., M.P. for Derby, did not think that the village of Spondon required an additional supply of water.

G. W. Stevenson, Esq., examined by Mr. BIDDER.

I am an engineer, practising in London. I have constructed water-works in many provincial towns. I do not think that the scheme now propounded is a good and effective one for the purpose of the water supply. I think that the Derwent is becoming more polluted. There is a very substantial amount of filth and polluting matter coming into the river. From the Belper Gas-Works I saw tarry water flowing into the stream. I examined the Belper Brook as it runs through the grounds of one of the Strutt family, and I saw sewage hanging to the sides of the brook; and there was also a pipe laid in the bed of the brook conveying the filthy stuff to the outfall into the Derwent, and discharging its contents with very great velocity and in great volume right into the river. That is four miles from the works. The stuff in the pipe was abominably filthy. I attribute the goodness of the company's water, such as it is, to the spring water which they get from the gritstone. There in no question about that being better water than the Derwent. Common sense tell us that, independently of chemical analysis. In hot weather the Derwent is at its minimum flow, and is most strongly contaminated with sewage. It fails most where most reliance is to be placed upon it. I was prepared, had the committee allowed it, to show six other alternative sources of supply. I do not think it is to the interest of the public or a wise thing to construct expensive works, such as those proposed by the bill, for the purpose of drawing water from the Derwent. If so, the town will be perpetually saddled with Derwent water, and it is a very improper source to which to go. It is the cheapest, no doubt. It would be better that the water should be taken from the Derwent rather than from the filter-tunnels. The area which the company propose to include will be about 70 square miles. Most of the villages have an abundant supply of good water already, and some of them are above the level of the service-reservoir of the company; and that will involve works for which the company have no power. I think the supply of water should, for many reasons, be in the control of the local authority, and not of a private company. I think water is an exceptional article, and should not be treated solely as an article of commerce. It is a sanitary agent, and ought, therefore, to be in the hands of the local authorities, who also make the quality of the water their first consideration. In reference, also, to the control of the streets, both water-works and gas-works, I think, should be under the control of the local authority. Great stress had been laid by Mr. Hawksley upon the sufficiency of the general Acts for preventing streams being fouled. We know that those acts are utterly insufficient for that purpose. Actions are constantly arising, and continually being referred to arbitration. Manufacturers are entitled by user to foul streams to a great extent, and local authorities get over the obligation to purify their sewage entirely by intercepting it, and abstracting the solid matter from the liquids, and sending the liquids into the streams, which liquids are as noxious as the solids; and therefore there is no reliance to be placed upon the general Acts, nor upon the interference of the Home Secretary, for preventing the pollution of rivers.

T. B. Foster, Esq., examined by Mr. BIDDER.

I am a civil engineer, practising at Manchaster, and have been engaged more or less on most of the water-works in Lancashire. I know the Derwent and the valleys round. I consider the river water is not the best that could be supplied to the inhabitants of Derby. It is cheap, certainly. I think the stream must get more and more foul as time goes on and the population increases. I estimate that the dry weather flow of the Derwent would not exceed half a cubic foot a second for every 1000 acres, making a total, for 25,000 acres, of 67,300,000 gallons, against 330 million gallons given by Professor Ansted.

Mr. *J. Heron*, town-clerk of Manchester, spoke to the manner in which that town was supplied at the present time. It is supplied by a corporation, who have carried out a very large scheme, upon which £1,750,000 has already been expended. The works had been carried on very satisfactorily—quite different to what they were when in the hands of a company. It is better, both for cheapness and effective and through distribution.

Cross-examined by Mr. SOMERSET: There is no doubt that the cost at Manchester is very large, but the water supply is very cheap. The corporation supply gas and distribute water. We get water by gravitation and springs; the most distant point being about 20 miles. Our water is equal to anything in the kingdom, except Glasgow. When our works are complete, we shall have at least 25 million gallons a day for distribution. We are now distributing about 14 millions. The water is not polluted by sewage at all.

FRIDAY, JUNE 12.

Mr. RODWELL said that he had to address the committee on behalf of the corporation of Derby, and he trusted, whatever decision the committee might come to they would think they had fair and proper grounds to justify them in taking the course they had in reference to this bill. It involved questions of the highest importance—questions which were agitating the public mind to a very considerable extent throughout the length and breadth of the land—viz., the water supply of the towns of England. He did not know that he ever dealt with a case more beset with difficulties than this one, and in which there was more conflict, both with regard to fact and with regard to theory. The real point of the case was, what was to be the future supply of Derby. The committee were called upon to legislate, as it were, for almost all succeeding generations; but he contended that the promoters had failed to make out a case for their bill. There was not a tittle of evidence to show that there was any increasing demand for water within the limits authorized. Mr. Hawksley himself, who generally came up to the mark pretty well, had said that a larger supply than they were now giving out was not necessary for present purposes. The learned gentleman reviewed a considerable portion of the evidence with reference to this point, and ventured to think that the corporation of Derby would have been wanting in their duty had they not, upon a question which interfered so much with the daily comfort of all the inhabitants, taken this matter up. They had had witnesses called who said they should be glad to have the water; but was there anything like what might be called a demand for the water in the villages, or anything like a formal application on the part of the residents in those villages for the bill—anything like a memorial, or anything of that sort? Three or four landed gentlemen had come forward and said they should be glad of the water, but that was the case with every village in England. Neither in the town of Derby nor the villages were they pressed by any urgent necessity or immediate want, and altogether it was a perfectly hypothetical case with reference to the introduction of the water into those villages. The company said they had spent all their capital, and therefore thought it necessary to apply to Parliament for a larger scheme, and for more capital. Now, that was a circumstance in itself very pregnant with suspicion. It was merely an excuse for a money bill. His lordship was perfectly aware of this, that under the Water-Works Clauses Act, whatever the capital might be, they could charge upon it without reducing their rates, so long as they did not exceed 10 per cent. With all those companies, whether they were gas or water, their great object was to make their capital as large as they possibly could, in order that they might have a larger surface over which to spread their earnings and their income. When their dividend arrived at 10 per cent. they were then compelled by Act of Parliament to reduce their rates. They wished, of course, to make it as profitable as possible, and, instead of reducing their rates and keeping their profits at 10 per cent. upon their authorized capital, the simple process was to get, by some means or other, an extension of their capital, and then the dividends were extended over a larger surface than that of the original capital, and so they had a larger and better investment for their money. This, he suspected, was the real solution of the question. They ought, at all events, to satisfy the committee that for this capital there was some urgent necessity, and something beyond a desire to increase their capital and the number of their shares. If the bill was allowed, the immediate effect would be to increase the profit of an already very profitable investment, and, when the works came to be sold, the company would go to the local board, and say—"Now we have got this power our shares are worth so much, and you must give us 100 per cent. more than they are worth now;" that was doubling their capital. Mr. Rodwell then addressed the committee on the quality of the water. The public really wanted the best water, and it was perfectly clear that this could not be effected if the supply was from the Derwent. He did not doubt that the water of the river could be obtained at a cheap rate, but there was something in this case which showed that that water would not be the cheapest after all. He argued that any stream which was subjected to pollution ought not to be taken for all time as a source of supply to a large population like that of Derby, unless they were satisfied beyond the possibility of doubt that all other sources had been exhausted, and that was the only possible mode of supply to the town. Although the pollution might be reduced to a question of degree, there was enough to make the Legislature hesitate before they condemned the people of Derby to drink

that water. It was perfectly clear that there was a scum or discoloration at times upon the water of the Derwent; that was a fact which the other side could not deny, but which they had endeavoured to explain away. The learned gentleman then reviewed the evidence of the witnesses, and, on coming to that of Mr. Hawksley, said: Now you have Mr. Hawksley, who talks about the school, and he will not be offended when I say that he, having been in practice for a great many years, is something of the antiquated school—I think he does not keep pace with the discoveries of the present day, which are so very fast. He has so many other matters to attract his attention—so many things in hand and mechanical operations—that he does not condescend to attend to the researches of these scientific men—he ridicules them, or dismisses them with a laugh, and he says—"Oh, there may be a few silly people who differ from me." Dr. Frankland also said there was something in the water which they could not detect—it was a silent and mysterious operation in some form or other. It would not do to depend upon the success of the deodorizing system adopted by Messrs. Strutt, because hereafter that system might not be found to answer, and be abandoned. He would put it as a question of common sense and not as science, that if the springs in the watershed were impounded or collected before the water went into the Derwent, whether it would not be purer than if it was taken after it had flowed into the Derwent. He could quite understand the theory about slow and gradual deposit, because, as it passed slowly along it, the sewage would be appropriated, or a portion of it; but if there was a rapid stream, and there should be unfortunately any introduction of sewage matter into it, it seemed to him that it would be hurried on, although the volume of water might be great, and it might be brought to the very point where the water company proposed to take their water, and carry with it the seeds of mischief. Mr. Rodwell submitted that the witnesses were divided in their opinion as to the operation of filtration upon river water. If there was a word of truth in the theory that sewage could not be entirely removed from water which had become impregnated with it, then the case of the promoters was gone. Having combated the salient parts of the evidence, he said that he was not there to say that the water of the Derwent was actually undrinkable. He was only cautioning the committee against passing a bill for supplying water which was liable to the filth and pollution which arose upon the banks of the Derwent. Supposing there should be another visitation of cholera, then they were told that in a case of that sort a very small quantity of sewage imported into the water would have a most disastrous effect. In conclusion, the learned gentleman said that if the committee felt constrained to pass the preamble, then he should ask them to do that which had been done in the Liverpool case—to say that the bill should not come into operation until a certain period, say 1870, or until the corporation had had an opportunity of putting their case fully before the public again with reference to the supply of water; in other words, that if the corporation should establish another system of water supply—which they were prevented doing this time by the dexterity, to some extent, of the water-works company—then the corporation should become the purchasers of the water-works, if they could satisfy a committee that the water which they had was better than the Derwent water. No ill result could happen to the company, except the delay which might be occasioned by their being kept out of the funds for a short time, because, of course, if the corporation came forward they would do so under the local Act, which enabled them to purchase the water-works, and the company would get every compensation for their property.

Mr. VENABLES replied at considerable length. He could not think that the committee would seriously consider the proposition of his learned friend, supposing that they should feel themselves constrained to pass the bill, and he contended that such a thing would be entirely anomalous and opposed to modern legislation. From the beginning to the end he had never heard a more strongly contested project in which the evidence proved to be so thoroughly harmonious. The water had been over and over again called river water, but it was no such thing—that was to say, it was not taken out of the river, but from wells sunk a certain number of yards from it, the water being filtered through the ground first, and after that subjected to artificial and ordinary filtration, which was probably superfluous. Again, it had been said by chemists who were eminent in their profession that the water in the river was better than the water in the service-reservoirs—that was to say, the water in the service-reservoir was mixed with spring water, and was not so soft, though it might be somewhat less pure. If any impurity was in the water, surely they could detect it, and he really did not see the use of science if scientific analysis was to be treated as even more fallacious than the senses. First, they were not to drink what appeared to be to their senses bright water, because it contained a hidden poison in it; and secondly, when they had ascertained by analysis that it had not that hidden poison in it, then they were to disbelieve it still. They had the evidence of some of the first chemists in England to say there was no pollution in the water, and it had been admitted, on the other side, that their analyses were strictly accurate. There was not the slightest proof, in any single instance, that any person's health had been injuriously affected by the water. Dr. Frankland did not venture to tell them a single instance in which disease had been attributable to previous sewage contamination. On the whole, he (Mr. Venables) considered that the inquiry had been generally grossly exaggerated, although it was probable that sewage contamination was injurious. It could not be doubted that the population of Derby was increasing, and the demand likewise. It was the universal practice of prudent water companies and their judicious advisers to come for additional capital before they absolutely ran short. The Derby Company proposed to take a supply for 30 years, and though they asked for a share capital of £60,000 and a borrowing power of £15,000, they were not going to spend it before they wanted it; they must lay out a considerable sum in the construction of the works, but a large portion of that capital was applicable to distribution, to new service-pipes, and extensions into new parts of their existing districts. Under all the circumstances, the learned gentleman contended that the people of Derby were much more directly interested than the company were in the success of the bill, and not the slightest evidence had been given, from first to last, to show that they would injure anybody, or, if the bill passed, any benefit which any person could receive would not be conferred.

The committee-room was then cleared, and on the readmission of the parties,

The CHAIRMAN said that the committee had passed the preamble, striking out the 5th section, describing the proposed new district, and the committee were of opinion that the new capital should be strictly confined to the wants of the old district, and the prospective increase of the population of that district within the next ten years.

Mr. RODWELL said that he did not intend to propose any clauses.

On clause 26 being considered (regulations as to baths),

Mr. SHRUBSOLE said it had been found that the Water-Works Clauses Act of 1863 was deficient in reference to this matter. The clause was inserted in order the more effectually to secure the company against waste.

Mr. HAWKSLEY said that in the Act of 1863 there were no sufficient provisions for securing the putting in of the proper apparatus, and consequently in nearly all the Acts passed since that year there was additional power given to enable companies to make regulations.

The clause was allowed, and, with regard to capital, the committee granted £40,000, with £10,000 borrowing powers.

The remaining clauses were agreed to.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

CITY COURT OF SEWERS—GUILDHALL, TUESDAY, SEPT. 8.

THE CITY OF LONDON GAS ACT.

At the Meeting of the Commissioners this day—Deputy DE JERSEY in the chair,

The CLERK (Mr. DAW) stated that he had received a letter from the Board of Trade, signifying that their lordships had appointed Dr. Letheby to be chief gas examiner; Mr. F. J. Evans, Mr. J. H. Patterson, and Mr. J. S. Peirce, to be gas referees; and Mr. C. Parkes to be auditor, under the powers of the City of London Gas Act.

The CHAIRMAN observed that, under the new Act, the corporation had to appoint a person as gas analyst, and he suggested that the subject should be mentioned at the next Court of Common Council, and that they should be asked to refer it to the Special Gas Committee of their body, with power to confer with the Streets Committee of the commission on the matter.

Mr. BONTEMS agreed with the chairman. It was most advisable that that course should be adopted. He then moved—"That the said Act be referred to the Streets Committee to confer with the committee that may be appointed by the Court of Common Council to carry out the provisions of the said Act."

Mr. F. COX seconded the motion, which was agreed to.

CANTERBURY GAS AND WATER COMPANY.

The Half-Yearly Meeting of the Company of Proprietors of the Canterbury Gas and Water Company was held on Monday, August 31—GEO. FURLEY, Esq., in the chair.

The CHAIRMAN said he had much pleasure in congratulating the shareholders on having got through the difficulties which at first threatened to cause some serious proceedings. The works they knew were lately in the hands of the contractor, but now the company had them in their own hands. When the late contractor had control over them water got into the tank several times, and he had demanded the sum of £362 for extra work, &c. The tank, through the exertions of Mr. Rayner and Mr. Jones, the latter the company's collector, had been completed, and was now in such a state as to be usable, but not until a sum of £214 19s. 5d. had been expended. They were much indebted to their solicitor, who had endeavoured to defend the company in an action brought against them by their late contractor to claim the sums of £120, held in reserve, and £362 for extras, the result being that the solicitor awarded him only the sum of £30, each party to pay their own costs. They must give some substantial acknowledgment to Mr. Rayner, and also to Mr. Jones, who had assisted the former in carrying out the work, which would have required the services of another contractor had that gentleman not stepped in. On referring to the letter of Mr. Homersham, the engineer of the water-works, they found that the two bore-holes were completed, and that he (Mr. Homersham) held the wells and bore-holes to be satisfactory, and might be depended upon to furnish a supply of water at all seasons, and meet the requirements of the inhabitants of the city. The reservoir on St. Thomas's Hill was nearly completed, and the works on the whole would soon be in such a condition as to satisfy the shareholders.

The following report and balance-sheet were then read:—

Your directors report that since the last half-yearly meeting they have been compelled to defend an action brought against them by the contractor for the new gas-tank for the balance of £120, held in reserve to meet any deficiency in the work, and for a large sum amounting to £362 for extras, as well as a further very large sum claimed by him on the case coming before the arbitrators. They are happy to report that the action was successfully defended, and a sum of £30 only ordered by the referee to be paid by the company, each party paying his and its own costs. Acting for the best interests of the shareholders, your directors took possession of the works, and have been enabled to complete the tank and make it water-tight. The gasholder has also been completed, and is now in use, thereby enabling the company, by increased storeage, to provide better for the wants of the consumers during the approaching winter.

The cost of the tank has been £1218 19s. 5d., exclusive of the law costs of the company's solicitors, which have not yet been delivered. The cost of the gasholder, and the necessary pipes to connect it with the works, has been £2200 13s.; making a total of £3419 12s. 5d.

Your directors desire to place before the shareholders the very valuable assistance rendered by Mr. Rayner, one of the directors, in the completion of the tank. By his untiring energies, aided by Mr. Jones, the company's collector, the serious difficulties occasioned by the defective work of the contractor were overcome, and your directors are of opinion that the exertions of Mr. Rayner and Mr. Jones very materially contributed to the successful defence to the action before referred to, and the consequent very large saving of the company's funds. Your directors therefore think that they would be wanting in their duty if they did not recommend to the shareholders that some suitable and substantial acknowledgment be made to Mr. Rayner and Mr. Jones for their valuable assistance.

With respect to the water-works, the directors have to report that they have entered into contracts for various portions of the works, the pipes, and other plant necessary to carry out the same. The well has been bored to a depth of 494 feet, and the second boring is now being proceeded with. Mr. Homersham, the engineer, is satisfied with the sufficiency of the water, and your directors attention will be directed to carrying out the works as speedily as may be consistent with proper construction. The contracts and work hitherto done have been taken at amounts within Mr. Homersham's estimate, but, as the softening process is to be used, it will be necessary to extend the capital, and your directors propose that they should have power to raise 300 new shares, making the capital £20,000; of this sum, however, they only propose at present to issue shares to the extent of £19,000, and from the numerous applications made to your directors the whole capital authorized to be raised will be immediately available when required. The report of Mr. Homersham, the engineer, upon the state and progress of the water-works, is appended hereto.

The balance-sheet, as audited by Mr. Lancaster, shows a profit on the gas-works of £1273 5s. 9d., and on the water-works of £117 5s. 4d.; making together £1390 11s. 1d.

The debts due to the company, on the 1st of July last, amounted to £2430 7s. 10d., and the debts due from the company to £1849 16s. 3d.

The balances in hand at the same time were—

Treasurer's account	£2482	18	4
In the secretary's hands	7	6	1
Making together.	£2490	4	5

Your directors beg to recommend that a dividend at the rate of £6 per cent. per

annum for the last half year, free of income-tax, be declared upon the original stock, and that the new shareholders be paid interest upon their shares from the 31st of December last, or the several days of payment according as it may happen, until the 30th of June last, at the rate of £6 per cent. per annum, which will require altogether £1169 17s. 4d.

The following is the report of the engineer on the water supply:—

19, *Buckingham Street, Adelphi, London, W.C., Aug.* 12, 1868.

To the Chairman and Directors of the Canterbury Gas and Water Company.

Gentlemen,—The progress to the present time towards the construction of the works to supply the city of Canterbury and its neighbourhood with pure softened spring water, is as follows:—

Possession has been obtained of the land at St. Thomas's Hill, the site for the service-reservoir, and of the land at Wincheap, the site for the wells, steam pumping engines, and softening works; these being the two sites sanctioned by Parliament.

Arrangements have been made with Mr. Sankey for the right of way to lay a drain from the site of the works to Wincheap, through which the water raised by the pumping-engines can, when required, be conveyed to the river Stour, and through which the softening reservoirs, &c., can be completely emptied by gravity.

The contract for the construction of the covered service-reservoir on St. Thomas's Hill, and the laying of the main-pipes, &c., in connexion with the reservoir, let to Messrs. Gaskin and Godden, builders, Canterbury, is now more than half completed. No casualty of any kind has so far occurred in the construction of this work. I mention this because the lower portion of the reservoir and the deep cutting required to lay the main-pipe, &c., had to be formed in that treacherous soil, geologically speaking, known as the London clay formation; and it is a matter for congratulation that, through the care of the contractors and the dryness of the weather since this reservoir has been commenced, the work has been so far most successfully executed.

The cast-iron main-pipes for conveying the water to and from the service reservoir on St. Thomas's Hill, and the cast-iron distributing-pipes in connexion with the main, contracted to be supplied by Messrs. Bolckow, Vaughan, and Company, of Middlesborough, are many of them already delivered at Canterbury; others are on their way from Middlesborough to Canterbury; the remainder are in progress of manufacture at Middlesborough.

The wells and the bore-holes, two in number, for the supply of the water, are now drawing towards completion.

No 1 well and bore-hole was completed on the 17th ult. The bore-hole has been sunk by Messrs. Mather and Platt's steam boring-machine. The steam boring-machine was fixed and No. 1 bore-hole commenced to be sunk on the 11th of May last. The bore-hole is lined with cast-iron pipes, 26 inches internal diameter, to a depth of 50 feet from the surface of the ground, the cast-iron pipes being so fixed as to exclude all surface water from the wells or borings.

The bore-hole below the cast-iron pipes is 24 inches internal diameter, sunk through the solid chalk and layers of flints to a depth of 494 feet 6 inches from the surface, or 444 feet 6 inches from the bottom of the cast-iron pipes.

This bore-hole, as I have stated, was commenced on the 11th of May, and completed on the 17th of July last, being a period comprising 59 working days, or nearly 10 weeks. The boring, therefore, was sunk (including all stoppages from whatever cause) at the rate of rather more than 44 feet per week.

The boring-machine was shifted, and the second bore-hole was commenced sinking on the 27th ult. Since the 30th ult. the second bore-hole has been pushed forward night and day, and the completion of the second bore-hole may be confidently expected in the first week of next month.

The water in No. 1 bore-hole now stands at a level of 9 feet 6 inches above the surface of the water in the river Stour at Wincheap, adjoinding the Silver Hole Spring. When sinking this bore-hole, and at the depth of 328 feet from the surface, and beneath some hard chalk rock, covered by about 4 feet in thickness of bluish chalk marl, a fissure, 2 feet 4 inches deep, was encountered, so fully charged with water from the hills between Canterbury and the North Downs, that the water in the bore-pipe, as soon as the fissure was broken into, rose, at one jump, 3 feet 5 inches in level above the previous surface of the water in the bore-hole. At the depth of 451 feet the chalk strata were found to be very full of cracks and fissures.

The level of the water in the second bore-hole, which has now attained a depth of about 300 feet from the surface, does not rise within 2 feet 10 inches of the same level as the water in the first bore-hole, although the centres of the bores are only 11 feet apart. When the fissure in the chalk met with in the first bore-hole, at the depth of 328 feet from the surface, is again broken into, the water will stand at the same level in both bore-holes.

I have no doubt these wells and bore-holes may be depended upon to furnish a supply of water at all seasons, ample in quantity to meet the requirements of the inhabitants of Canterbury and its neighbourhood, even when the population shall attain to ten times its present number.

As the steam pumping-engines are intended to stand over the bore-holes, and the pumps to draw the water direct from the bore-holes, the engine and boiler-house could not be commenced upon until the bore-holes had been completed, and the machine had been removed.

One steam-engine and boiler has, however, been contracted for. The drawings and specifications for the engine and boiler-house, and other work to be erected at Wincheap, are ready.

I trust this contract will be let, so that this work can be pushed on with directly the second bore-hole is completed.

So far, the contracts for the pipes and other works have been let at a very reasonable price; the work is being soundly executed, and I trust the whole of the works, when completed, will be found, in every respect, to answer their intended purposes, at a very reasonable cost.—I am, &c.,

SAMUEL COLLETT HOMERSHAM.

Balance-Sheet, for the Half Year ending July 1, 1868.

Gas-Works Account.

Dr.		*Cr.*		
To Wear and tear	£100 11 5	By Rentals		£3,898 9 7
Salaries and wages	934 3 3	Residual products—		
Rates and taxes	74 10 9	Coke and breeze	£946 15 8	
Coals	2,514 16 9	Tar	47 5 5	
Purifying account	69 18 9	Sulphate of ammonia	64 4 6	
General expenses	72 5 3			1,058 5 7
Profit and loss	1,273 5 9	Fittings		82 16 9
	£5,039 11 11			£5,039 11 11

Water-Works Account.

Dr.		*Cr.*	
To Wear and tear	£24 8 0	By Rentals	£293 2 9
Salaries and wages	61 5 3	Fittings	6 15 4
Rates and taxes	15 15 0		
Fuel	62 1 0		
General expenses	19 3 6		
Profit and loss	117 5 4		
	£299 18 1		£299 18 1

Profit and Loss.

Dr.		*Cr.*		
To Bad debts	£54 14 3	By Gas-works	£1,273 5 9	
Balance available for dividend	1,486 8 2	Water-works	117 5 4	
				1,390 11 1
		Cottage-rents	£39 12 1	
		Interest on investments	110 19 3	
				150 11 4
	£1,541 2 5			£1,541 2 5

General Assets and Liabilities.

Dr.			*Cr.*		
To Plant, buildings, and machinery		£33,038 16 2	By Shareholders capital—		
Debts due to the company		2,430 7 10	Stock	£22,500 0 0	
Value of stock as under—			A shares	7,458 0 0	
Coals	£864 17 0		B shares	10,297 0 0	
Coke	54 2 0				£40,255 0 0
Tar	31 5 0		Unpaid dividends		13 17 6
Sulphate of ammonia	28 9 6		Debts due from the company, viz.:—		
Meters	138 19 0		Coals	£1,157 19 5	
Purifying materials	32 2 6		Trade accounts	567 6 9	
Fire goods	329 1 5		Balance of contract for new gas-holder	16 10 3	
Tools, implements, and general stock	239 4 5		Meters	107 19 10	
Fittings	82 7 4				1,849 16 3
		1,800 8 2	Reserve-fund	£1,205 18 3	
Contingent-fund		507 15 4	Profit and loss	1,486 8 2	
Water capital investments		4,543 8 3			2,692 6 5
Cash in hand—					
Treasurer	£2,482 18 4				
Secretary	7 6 1				
		2,490 4 5			
		£44,811 0 2			£44,811 0 2

After a little conversation, the report and balance-sheet were unanimously adopted.

It was moved by the Rev. F. ROUCH, seconded, and carried, that a sum of £50 be given to Mr. Rayner and £30 to Mr. Jones, the collector, as an acknowledgment for their valuable services.

Mr. RAYNER spoke in high terms of the collector's services, and mentioned the circumstances that made him take charge of the work.

It was then resolved—"That £3000 additional capital for the water undertaking be raised by 300 new B shares of £10 each."

A vote of thanks to the chairman closed the proceedings.

FATAL GAS EXPLOSION AT WEYMOUTH.—On Friday, September 4, an inquiry was commenced before H. Lock, Esq., deputy-coroner for the county of Dorset, into the death of Miss Mary Cooper, who had sustained fatal injuries from an explosion of gas at Weymouth. The deceased was in the employ of Mr. Hann, baker, of Bond Street, and was attending to her duties as shopwoman on Saturday evening, the 29th ult., when an explosion took place which destroyed the premises. On being extricated from the *débris* it was found that her right leg was broken, and that she was suffering from other severe injuries. She died on the following Thursday. After receiving evidence as to identity and the nature of the injuries, the inquiry was adjourned until the 10th inst. Mr. Hann was then examined, and stated that the meter which had been removed by the gas company to be tested was refixed on the 28th by a workman in their employ named Frampton, and that on the evening of that day an explosion took place by which he (Mr. Hann) was seriously injured. On the 29th Frampton and another man, named Atkins, came to replace the meter which had been blown away, and it was stated by two or three witnesses that these workmen had been drinking, and were not competent to do their work. They left the premises between six and seven o'clock, stating that they had made everything secure. Mr. Hann deposed that about half-past ten o'clock he smelt gas escaping, and tried the taps in the bakehouse, and that afterwards, when ascending the stairs towards the shop with a lighted candle, the explosion took place by which Miss Cooper received the injuries from which she died. No one had touched the pipes since Frampton and Atkins left. Dr. Odling, F.R.S., who had examined the premises, gave it as his opinion that there had been considerable leakage previously from the tap and service-pipe, and that the workmen left the fittings in an improper state, though whether the leakage from the service-pipe was the cause of the explosion he was not certain. Frampton and Atkins were examined, and stated that they did their work in a proper manner. After receiving other evidence, the jury returned the following verdict:—"We find that the deceased, Mary Cooper, came to her death by accident, and we wish our verdict to be accompanied by the following expression of our opinion: that the gas company, in future, should be extremely careful to send out steadier and more skilful workmen than we believe those concerned in the present instance were."

SOUTH SHIELDS GAS COMPANY.

The Half-Yearly General Meeting of the Shareholders of this Company was held on the 31st ult., in the board-room at the Offices of the Company—R Wallis, Esq., in the chair.

The Chairman having read the advertisement calling the meeting, said he was very happy to state that the directors came before them with a very favourable balance-sheet. It did not require any explanation from him, as both it and the report had been placed in the hands of every shareholder; they, therefore, might be taken as read. They would see by the balance-sheet that the company were in a very favourable position, and during the past half year they had increased their receipts without an increase of expenditure, which was certainly a most satisfactory circumstance. He moved that the report and accounts submitted to the shareholders be adopted.

The directors have much pleasure in stating that the affairs of the company are in a sound and healthy condition; and from the statement of accounts now presented they feel justified in recommending the payment of an interim dividend of 4½ per cent. on the old and 3½ per cent. on the new capital for the half year ending the 30th day of June, payable on the 8th day of September.

In consequence of the increasing demand for gas in the Jarrow district by the erection of new factories on the banks of the river, and the great increase of the population, your directors have thought fit to lay larger mains from the works at Shields to the Jarrow district at considerable cost, which will not be remunerating for some time.

It will probably be necessary to make a further call on the new stock of the company, to defray the expense of the extensions, about the end of the year.

Dr. *Profit and Loss Account, Half Year ending June 30, 1868.* *Cr.*

INCOME.				**EXPENDITURE.**			
To Balance on Jan. 1, 1868			£2,448 15 3	By Dividends on old and new shares, and arrears on old shares			£2,504 10 3
Amount taken from reserve-fund			400 0 0	Balance forward			344 5 0
			£2,848 15 3				£2,848 15 3
Balance			£344 5 0	Stock of coals, &c., Jan. 1, 1868			£449 1 5
Half year's gas and meter rents			6,016 9 6	Coals	£1,766 14 7		
Sale of coal tar	£251 6 1			Wages and superintendence	1,225 9 0		
Ditto coke	777 17 10			Salaries and collectors commissions	277 5 1		
		1,029 3 11		Mr. Sanderson's annuity	22 10 0		
Profit on sulphate of ammonia		195 13 3		Rents, £7 10s. 10d.; rates and taxes, £217 7s. 8d.	224 18 6		
Discounts	£31 9 1			Directors, auditors, and scrutineers fees	45 19 0		
Transfer fees, 17s. 6d.; certificates, 10s.	1 7 6			Lime, £54 4s.; water, £11 14s. 3d.	65 18 3		
		32 16 7		Retorts, bricks, &c.	373 16 3		
Corporation, upholding public lamps, lamp-posts, &c.	£166 5 6			Service-pipes, gas-cocks, tin, iron, and steel goods	140 3 4		
Less credited last half year	60 0 0			Cartage	186 18 0		
		106 5 6		Paving	6 10 6		
Old metal		4 8 2		Sundry small accounts, not exceeding £10, including postage and receipt stamps, petty expenses, carriage, &c.	140 12 3		
Service charges, and repairs to meters		31 2 6		Stationery, advertising, &c.	32 19 1		
Stock of iron tubing, gas-cocks, coals, coke, tar, and sundries		406 18 3		Oils, paints, &c.	26 4 6		
				Bad debts	65 13 8		
				Allowance for depreciation of works, plants, and mains, at 1¼ per cent. for half year	615 4 7		
				Interest on loans	£213 4 2		
				Less allowed by bankers	1 4 8		
					211 19 6		
						5,428 16 1	
						£5,877 17 6	
			£8,164 2 8	Balance to profit		2,286 5 2	
						£8,164 2 8	
Balance brought down			£2,286 5 2				

Dr. *Balance-Sheet, June 30, 1868.* *Cr.*

To Proprietors capital (old)			£40,000 0 0	By Plant, works, mains, &c.	£48,507 0 10		
Ditto (new)			4,000 0 0	Extensions to and in Jarrow	446 3 0		
Loans			9,720 0 0	Town ditto	65 6 4		
Reserve-fund account	£512 4 7					£49,018 10 2	
Less paid dividends in arrears	400 0 0			Less depreciation of 1¼ per cent. for half year		615 4 7	
		112 4 7				£48,403 5 7	
Revenue account—balance of profit		2,286 5 2		New work		27 14 3	
Sundry accounts owing for coals, lime, &c.		456 13 8		Meter account		1,376 5 2	
Deposits for gas		134 10 0		Retort ditto		700 0 0	
				Consumers gas accounts		3,048 14 5	
				Office furnishings		34 7 0	
				Sundry accounts owing for coke, tar, &c.		673 16 10	
				Dale, Young, and Co., bankers (deposit)	£2,000 0 0		
				Ditto ditto (balance)	29 4 0		
				Cash in hand of secretary	12 7 11		
						2,041 11 11	
				Stock of coals, coke, tar, and sundries		403 18 3	
			£56,709 13 5			£56,709 13 5	

Mr. James Anderson felt very great pleasure in seconding the motion which had been proposed by their excellent chairman, and he bore out all that he had said regarding the satisfactory condition of the company, whose prosperity he would not say was great, but moderate. While they endeavoured to do justice to themselves as a company, they had not the less endeavoured to do justice to the public, and whenever any complaints had been made immediate attention had been given to them. The directors had studied to make the company popular, and he believed that at the present moment it was so. Whenever it had been necessary to form a deputation to go to Jarrow, their worthy chairman was always the very first to volunteer his services, and this he did for the good of the company. The small attendance at the meeting to-day was an evidence that the shareholders had implicit confidence in the chairman and directors, and this indication of confidence was very flattering to the board, for it showed that the shareholders trusted them. As he had said, the company was moderately prosperous, and he hoped it might continue so for the future.

Mr. J. Ridley moved—"That an interim dividend of 4½ per cent. on the new capital be declared for the half year, payable on the 8th of September, by warrant on company's bank."

Mr. Shout seconded the motion, which was agreed to.

The Chairman, in accordance with the requirements of the company's Act of Parliament, moved that the seal of the company be affixed to the list of shareholders.

Mr. L. Armstrong seconded the proposition, which was carried.

A vote of thanks having, upon the motion of Mr. Ridley, seconded by Mr. Armstrong, been accorded amid acclamation to the chairman, and the same having been acknowledged, the meeting terminated.

Unlawful Appropriation of Water.—At the Worship Street Police Station, on Friday last, Mr. Joseph Rosotière Lloyd, of 8, Shepherdess Walk, attended to answer three summonses taken out against him at the instance of the directors of the New River Company, for that he, not being a person who had agreed to be supplied with water by the company, did take for his own use and benefit water from a butt on the premises No. 10, Shepherdess Walk, on the 5th, 7th, and 8th of September inst., contrary to the 59th section of the Water-Works Clauses Acts 1847, incorporated with the New River Company's Act, 1852. From the opening statement of the prosecuting solicitor, it appeared that since 1865 the defendant had not been supplied with water, as prior to that time he had. It was cut off on the 23rd of June, because it was found the defendant had not supplied his water-butt with a ball-tap such as was required by Act of Parliament, and the non-supply of which caused a waste of water. After that date no water had been laid on, and although it was suspected that he had the use of water, it could not be ascertained until the commencement of the present month. On the days mentioned in the charge against the defendant, it was discovered that he supplied himself with water by a pipe running as a syphon from the water-butt on the premises of No. 10 into the defendant's water-butt, of course not paying any water-rate. The defendant's solicitor admitted that his client had had the water on the days mentioned, but he added that when he had applied to have the water laid on again the company demanded 5s. for so doing, and then declined unless the defendant went to the additional expense of supplying a ball-tap. The magistrate said that for the protection of the public generally the Act required water-butts to be supplied with ball-taps to prevent waste; but as the offence was admitted, he should only fine the defendant on one summons, 40s., with costs for the three.

Utilization of Sewage.—Mr. R. B. Grantham, C.E., F.G.S., has been commissioned by the British Association for the Advancement of Science to draw up annual reports on the treatment and utilization of sewage in connexion with the drainage of towns, in order that such facts and information as may guide future operations may be recorded from time to time. He is requested to include in the details of each report—1. The special circumstances of each case, such as the extent of district, the population, and the number of houses with or without the benefit of drainage. 2. The character of the sewage and water supply adopted in the district, and the quantity of sewage at disposal. 3. The mode of disposing of the sewage, with description of the works and their cost. 4. The result pecuniarily to the district, and to those who are selling or applying the sewage to the land or otherwise in any form whatever.—*Gardeners Chronicle.*

Pollution of the River Aire.—Mr. W. R. C. Stansfield has obtained an injunction against the Bradford Town Council, to prevent their fouling the river Aire. Complaints have frequently been made by Mr. Stansfield, but it is only since the Bradford Town Council have construeted a main sewer which empties itself into the Bradford beck, the impurity of which flows into the Aire, that he has threatened the corporation with legal proceedings.

Halifax.—The storeage for the Halifax Corporation Gas-Works is being greatly extended, at a cost of between £20,000 and £30,000. A contract for a new gasholder has been let to Mr. B. Whitehouse, of West Bromwich; the amount of the contract is £9000.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

The following report and statements of account were presented to the Shareholders at the General Meeting of the Company, held at their Office, 29, St. Swithin's Lane, London, on Friday, Sept. 4, 1868:—

Your directors have much pleasure in presenting to you the statements of account for the half year ending June last. From the profits at their disposal your directors recommend the declaration of a dividend at the rate of 7 per cent. per annum.

Dr. — *Profit and Loss, Half Year ending June 30, 1868.* — *Cr.*

To Coals			£8,412	7	2	By Balance brought from last half year's account	£3,469 3 5
Purifying materials and process			137	19	0	Sale of gas	14,647 14 1
Repair and maintenance of meters, mains, service-pipes, and other works			1,399	17	2	Coke and breeze	3,294 15 10
Wages			2,780	3	6	Tar and other residuals	509 17 6
Lamps—providing, lighting, extinguishing, cleaning, and repairing			269	11	9		
Rent, rates, and taxes			338	4	0		
Salaries, collectors commissions, and payments to directors			1,141	17	8		
Interest on loans			574	18	6		
Professional charges and incidental expenses			85	16	11		
Estimated discounts and bad debts on rental			160	18	7		
Dividend paid to proprietors—6 per cent. on £100,000 capital, raised under Act Vict. 2, c. 38	£3,000	0 0					
Dividend paid to proprietors—6 per cent. on £5050 capital raised under Act Vict. 29, c. 184	151	4 0					
			3,151	4	0		
Miscellaneous payments—							
Amount carried to reserve-fund			317	19	5		
Balance carried to next half year's account			3,170	13	2		
			£21,921	10	10		£21,921 10 10

Dr. — *Balance-Sheet, Half Year ending June 30, 1868.* — *Cr.*

To Capital raised—						By Cost of works		£125,971	3 8
Under Act Vict. 2, c. 38	£100,000	0 0				Ditto (add extensions made during the half year)	650	0 5	
Ditto ditto 29, c. 184	5,550	0 0						£126,621	4 1
		£105,550	0	0		Amount invested of the reserve-fund		2,004	1 6
Amount of loans		24,500	0	0		Calls unpaid		10	0 0
Reserve-fund		2,004	7	6		Amount owing to the company for gas, coke, residual products, fittings, &c., exclusive of estimated bad debts		8,442	11 3
Amount owing by the company		9,079	6	6		Coals in stock		1,864	12 4
Unclaimed dividends		0	10	4		Residual products and other stocks		1,610	15 8
Balance as above		3,170	13	2		Cash in hands of treasurer, cashier, &c.		3,751	12 8
		£144,304	17	6				£144,304	17 6

Appropriation of Profit.

Profit unappropriated last half year		£2,004	7	6	Dividend for half year on share capital, at 7 per cent. per an.		£3,685 3 0
June, 1868—Profit balance		3,170	13	2	Balance forward		1,489 17 8
		£5,175	0	8			£5,175 0 8

The various enlargements of works referred to in the report of the directors dated the 6th of March last have been for the most part completed, and will all be available for use in the forthcoming winter.

Your directors have, with great regret, to announce the loss by death of their highly valued colleague, Mr. James Warren. They have also to announce the retirement of their much esteemed friend, Mr. Samuel Preston Child, the senior member of the board. Mr. John Maughan and Mr. James Warren, duly qualified shareholders, have made application to fill the seats thus vacated, and your directors have pleasure in recommending them to the proprietors for election.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

The Seventh Annual General Meeting of this Association was held in the School of Arts, Edinburgh, on Wednesday, the 29th of July—JOHN REID, Esq., engineer of the Edinburgh and Leith Gas Company, president, in the chair.

The minutes of the last annual meeting, and also minutes of committee meetings held during the year, were read and approved of; after which the election of office-bearers for the current year was proceeded with, when the following gentlemen were nominated and unanimously approved of—viz., Mr. G. R. Hislop, engineer, gas-works, Paisley, president; Mr. T. Whimster, gas-works, Perth, vice-president; Mr. W. Mackenzie, gas-works, Dunfermline, secretary and treasurer; Mr. W. Fraser, Inverkeithing, auditor; and Mr. John Young, gas-works, Hawick, Mr. G. F. Cussiter, gas-works, Dalkeith, Mr. W. Robson, gas-works, Selkirk, Mr. W. Stiven, gas-works, Inverness, members of committee.

The applications of several gentlemen to be admitted as members of the association were next considered, when ten new ordinary and three extraordinary members were admitted in terms of the rules.

The remaining private business having been disposed of, the retiring president addressed the association. He congratulated the members on its continued prosperity, and the annual accession to its numbers, which now amounts to upwards of seventy members, and, after some remarks tending to show the benefit already derived from their annual gatherings, he reviewed the general characteristics of the gas business in Scotland for the past year. For the first time in the history of Scottish gas companies a good many establishments have fallen back in the amount of gas made and consumed as compared with the year preceding, solely attributed to the general dulness of trade, while with some the increase has been nearly the average, but on the whole the consumption may be reckoned about equal to that of 1867. Prices having advanced in many towns, the revenue on the whole showed a marked increase. The great rise in the price of cannel coal about eighteen months ago—in some instances about 20 per cent., owing to a kind of panic among coalowners—has again receded to the average prices of former years, and one result has been the opening up of several new cannel pits and the introduction of some new and excellent varieties of first-class coals, and at the present time there is a larger choice of this article than we have ever before enjoyed. The export trade in cannel coal has also fallen off very considerably; and the United States may now be considered virtually closed to this trade, owing to the high import duty of 6s. to 7s. per ton levied on cannel coal imported from this country. It may further be noticed that the sudden and great rise in price referred to had the effect of driving gas managers generally to employ a larger proportion of lower classed cannels, from which it is well known the desirable results as to quality are derivable by some modification in the temperature and time allowed for distillation. The extensive experiments being made all over the country with hydrocarbon oils, as a substitute for cannel in the production of gas, will no doubt result in the successful employment of this substance—so long, at least, as its price is low. He mentioned as his own opinion, founded on an extensive set of experiments some time ago, that it will be found that the best results in every way with these oils will be obtained without admixture of any kind, the distillation being conducted on the same principle as when gas was originally obtained from fish and other oils, in the earlier days of gas lighting The attention of the association might be well directed to the matter of leakage, regarding which there was an unaccountable discrepancy in the various per centages of loss sustained in different towns; and he thought the association would approve of the nomination of a committee to procure data on this important subject, and make it a subject for discussion at next annual meeting. In illustration of this matter a table was exhibited, showing the greatly differing per centages of loss by the thirteen London companies, as drawn from the printed reports of the Metropolis Gas Bill Committee's reports of last year, from which it appears that the aggregate volume of gas unaccounted for in London amounted to about 1580 millions of cubic feet—a quantity about equal to the whole manufacture by the four largest companies in Scotland, employed for lighting Edinburgh and Glasgow. After thanking the association and the office-bearers with whom he was associated during the past year for their forbearance and kindly co-operation with him in the performance of his duties as president, he now gave place to the gentlemen whose papers were to follow, and to which he bespoke careful attention.

The following papers were then read to the meeting in accordance with the programme:—

NOTES ON METERS, WET AND DRY.

By Mr. JAMES ROBB, Gas-Works, Haddington.

Meters, wet and dry, are instruments which play an important part in the economy of a gas manufactory; and upon the general accuracy of their working much of our success as gas managers depends. The few remarks which I am about to make have reference more especially to the wet meter, which you know is almost universally used in Scotland.

As to the accuracy of the wet gas-meters, when properly made and regularly attended to, I believe no reasonable objection can be taken; but there is one phase of their character which I think has not received that amount of attention which its importance demands. I allude to the fitness of the meter to perform the duties which may reasonably be expected from it, without requiring such an enormous amount of labour, resulting from the frequency with which it requires to be replenished with water, as is now rendered necessary by the small range of error allowed by the "Sales of Gas Act." In my opinion, that forms the only objection to the use of the wet gas-meter worth one moment's consideration. All other objections which are brought against the wet meter by interested parties are frivolous, and can be overcome by care and attention in placing.

We have had their durability sufficiently tested. They have outlived one generation; as an instance and proof of which I will place this cylinder before you [showing it], which has supplied gas regularly from the beginning of the year 1835, down to January, 1868. It is as sound as on the day it came from workshop, and was lifted to make way for a larger.

Now, as to the water question, we have one specious objector stating that the wet meter never can become an instrument of correct measurement from the proverbial instability of water—although, mark you, he goes on to say that in this country "the only legal standard or unit of measure for the sale of gas by meter is the cubic foot, containing 62·321 pounds avoirdupois weight, of distilled or rain water."

Believing the water to be a weak point in the wet meter, as I do, you will readily believe me when I tell you that my attention has been strongly directed to find out some way, mechanical or otherwise, of getting rid of the disagreeable necessity of carrying water to adjust the meters, which you all know managers in small towns such as Haddington have to do. Mechanically, I thought it might partly be overcome by increasing the diameter of the measuring drum and lessening its width; but as that was more a manufacturer's question, I could only suggest. That principle, however, I am glad to see is now acted upon, as regards all the smaller sized meters, and with the best results.

Becoming anxious to ascertain exactly the amount of water really carried off or evaporated from our meters in a given time, about eight years ago I commenced a series of observations which have been continued to the present time, carefully measuring the quantity required at each successive survey to fill them up to the proper water level. This I have noted down in the following tabular form:—

Year ending May 15.	Number of Meters.	Water Required in Gallons.	Gas Passed through Meters.
1860	528	61	3,170,000 c. ft.
1861	517	63	3,040,000
1862	535	62	3,325,000
1863	534	62	3,140,000
1864	539	64	3,460,000
1865	542	66	3,500,000
Average	539	63	3,260,000 c. ft.

And for the three winter months in each year—that is, from November 15 to February 15—the quantity of water necessary to readjust the above number of meters amounted on an average to 24 gallons, which again divided by the average number of meters, thus, $24 \times 277{\cdot}274 = 6654{\cdot}576$ cubic inches; which again divided by 539, the number of meters, gives 12·346 cubic inches of water as necessary to replenish the waste of one meter during three months working. The average quantity of gas passed through these meters in the three months indicated above of each year noted, amounted to 1,400,000 cubic feet, averaging per meter nearly 2600 cubic feet. I have said enough on that point, and will not detain you longer, but will merely state that those who wish to see this subject carried out to a greater extent may consult vol. ix. of the JOURNAL OF GAS LIGHTING.

The result of the first year's observations astonished me, on finding that I had nearly 6 cwt. of water to distribute yearly in my visits from door to door. Well, in the winter of 1859, and also in 1860, a severe frost occurred; the thermometer fell to 6° below zero, sealing up all our meters standing in exposed situations, causing much inconvenience to our customers and serious loss to the gas company, as well as a world of trouble to myself. In my extremity I tried methylated spirits and glycerine, and in the course of my inquiries as to the nature and properties of glycerine I learned that it possessed properties which I thought would render it invaluable as a substitute for water in filling gas-meters. Its specific gravity ranges from 1250 to 1264; it has an extraordinary affinity for water, mixes with it in all proportions, and does not freeze at very low temperatures. Determined to give it a trial, I prevailed upon one gentleman to get a quantity—a gallon—and try it upon two meters belonging to him. He did so, and from January, 1860, to this hour these meters have not required in any way to be meddled with. I have had other meters filled up with it in certain proportions; and what I am anxious about, in bringing this matter before you, is that those of you who have superior facilities and greater means at your command should make investigations into this matter, so that the exact quantity of glycerine necessary to mix with the water in the different sized meters should be determined. I know the expense will be urged against it, but if a demand were to arise for it, I have no fear but that the science of the present day would soon find a method of cheapening it, or, at least, some substitute possessing those properties which render it suitable for the purpose for which we want it.

The subject is one, however, which is well worth your attention; and it is my firm belief that we gas managers have hitherto left the details of the meter too much in the hands of the manufacturers, who have devoted their attention almost exclusively to the question as to how the gas-meter was to be made an instrument that would neither "cheat nor be cheated," altogether ignoring the fact that the finer the line and the nicer the point at which the gas is shut off imposes additional labour upon us.

I intended saying a few words on the dry gas-meter, but, having trespassed so much on your time already, I will only intimate my opinion, that all the dry gas meters made in Scotland which have come under my observation are specimens of beautiful and at the same time substantial workmanship. Into their merits I will not enter: they are as yet only in a state of probation, and it will require a few years working before I am able to pronounce an opinion as to their merits or demerits. Dry meters have, like the wet meters, their weak points also, which I know from experience, having carefully watched for twenty years the working of a good number of English made ones; and, although it is often said that there is "nothing like leather," I am afraid, if nothing better than leather can be found, or some way of preparing it better than there is at present, we may despair of ever seeing a perfect and at the same time lasting dry gas-meter.

Theoretically, I am in favour of the dry gas-meter, and from the bottom of my heart have a thousand times wished that all our meters were good, reliable dry ones. Then the evils which I have described would no longer exist; our surveys would be pleasant in comparison to what they are now; and the time gained would be turned to good account in superintending the operations in the retort-house.

ON THE COMBUSTION AND ILLUMINATING POWER OF COAL GAS.

By G. R. HISLOP, Engineer, Gas-Works, Paisley.

An ever-deepening conviction of the importance of a knowledge of the theory of combustion to every gas manager, has induced me to bring such a subject before you at the present time. Apart from all visible forms of combustion, its study in relation to our bodies is one of surpassing interest—our lives hang on the process, as the moment it ceases within us that moment we die. The term "combustion," therefore, embraces not only those visible and more or less vigorous forms of combustion in external nature, but also that process carried on in the lungs of every animal on the earth's surface; all depend on certain elementary bodies for the production of such phenomenon.

The particular form of combustion, however, of which I have at present to speak, is the combustion of coal gas. It is not enough for the manager of a gas-work that he understand and be able to manufacture and send out a gas of such purity and power as shall suit the requirements of his gas consumers; his interest in it must not end at the meter by which the amount of the account is indicated, but, on the contrary, he must follow it until it no longer retains the name of coal gas, but has passed into union with the oxygen of the atmosphere, forming new compounds, which in imagination he can trace to every part of the earth's surface, as adding to the stature of the palms of Africa or the oaks of Britain, or in part as being quaffed off in the form of water to quench the thirst of man or beast. The chief constituents of all coal gas are carbon and hydrogen, in variable proportions. By the process of destructive distillation these two gases, which were previously in the solid, have been converted into the gaseous state; leaving, however, a large amount of the carbon in the solid state fixed or united to the ash, which is termed coke. But following at once the gaseous chemical compound through the pipes to the burner, where our special inquiries at present must begin, we apply a light or heat of sufficient intensity to set the process of combustion or chemical union into active operation. But how, it may be asked, can the phenomenon of combustion and that of flame be explained? Combustion, it may be answered, can only be effected by the intimate union of one element in nature with another. In this case the gas contains the one, which is carbon, and the atmosphere the other, which is oxygen. Although coal gas be called a combustible, it cannot of itself be consumed. Combustibility, therefore, is not a quality of combustion. The latter can only be effected by the intimate union of oxygen with the combustible; hence, in common phraseology, we must not only have a combustible, but a supporter of combustion, neither of which, in the true sense of the term, can be consumed alone. The luminosity of all flame depends upon the presence of solid matter in a fine state of division, and that solid matter is carbon. Flame is due to the combustion of hydrogen; it forms the blue part of every flame, where it is separated from the solid carbon by a process of decomposition under a high heat, which heat always attends its own combustion, and on which the luminosity of flame depends, by its action on the carbon. Consequently, although the carbon and hydrogen of the gas be chemically united previously, they are separately consumed. When coal gas is largely mixed with air, however, previous to combustion—as in the Bunsen burner—no separation of the carbon in the solid state takes place, but is united with the oxygen of the atmosphere the instant it leaves its union with the hydrogen; consequently no light is produced.

An immutable law in nature, which regulates the combination of matter, points out to us the exact and constant proportion of each of the elements named to be presented to each other in order to effect complete combustion. To every atom of carbon we must present two atoms of ogygen, which produces CO_2 (carbonic acid); and to every atom of hydrogen a third atom of oxygen must be presented, which produces water; both of which are the inevitable products of the complete combustion of coal gas, or any substance containing carbon and hydrogen. Should the supply of oxygen, however, fall short of the amount named, CO (carbonic oxide) would be the resulting product, and then combustion being only half completed, it must necessarily be at the expense of 50 per cent of the intensity of the light. When the supply of oxygen is limited aldehide is also formed—a compound of carbon, oxygen, and hydrogen ($C_4\ H_4\ O_2$); it is produced also when the vapour of alcohol or ether is passed through red-hot tubes. To this may be attributed the peculiar suffocating smell arising from imperfect combustion. In addition to all such evils, an amount of the carbon, especially in the case of rich gases, passes off in the free state, as soot. Whether, therefore, as regards the economical combustion of illuminating gas, coal, or coke, everything depends upon the proper regulation of the supply of air to the combustible which contains the required oxygen to the extent of about 21 per cent. of its volume.

With regard to the combustion of coal gas, too much importance cannot be placed upon the proper selection of burners, as upon this depends the saving or throwing off waste into the atmosphere 10, 20, or 30 per cent. of the light-giving principle of the gas, giving rise to complaints from high accounts for a given amount of light, and generally to a wholesale condemnation of the gas as being of the most dirty and sooty description.

Numerous patents have been taken out for burners for the more effective combustion of illuminating gas, many of which are valuable—such as the adamas-pointed and silicate of magnesia burners, for Scotch gas; Sugg's patent Argand burner and Scholl's platinum-mounted gas perfecter, for English gas; these improved burners, effecting a saving of from 10 to 20 per cent. or more, have to a great extent superseded the original and defective iron ones. With the best and most perfect burners, however, a large amount of gas may be wasted by imperfect combustion, unless certain important points be attended to, and these are—first, that the gas be not passed to the burner under a high pressure, by which noise and spurting is produced; secondly, that it be not burned in a current of air; and thirdly, that the gas be not passed to a compartively large burner under a weak pressure. In the first and second instances sufficient time is not permitted for chemical union, and consequently the evils enumerated arise. It must be remembered that in the process of combustion, as well as in all other chemical processes, a reasonable time must be allowed for combination, and that the neglect of this condition is ruinous and detrimental. In the third instance a similar result takes place, but in a somewhat different way. The gas being allowed to issue from a burner under a low pressure, it is not sufficiently spread to admit of the oxygen of the air reaching every particle of carbon in the flame, and the latter passes off in the free state, or with only one atom of oxygen instead of two.

Under the first and second points I now wish specially to bring under your notice the large amount of waste resulting from the use of glass shades over the burners, and to point out a means for the complete recovery or prevention of such loss. I may state at the outset, however, that the loss to which I refer is not so much that loss which every one knows is sustained by the interception of the rays of light by the shade, but a loss which I shall show as being produced by an air current. Hitherto nearly all the loss consequent on the use of glass shades has been attributed to the interception of the rays of light, but that such is erroneous I have abundantly proved by experiment. It is some time since I observed such waste, but more recently I made a series of experiments to satisfy myself as to the extent of it. The results prove that 43 per cent. of the loss sustained by the use of a transparent shade is attributable to the rapid current of air which is induced to pass through the shade, particularly all such as are more or less contracted at the top, or such as the pine-shaped one now before you. With such shades especially it will be always observed that the flame is very irregular, much drawn out, and elongated at the edges. The current of air rushing as through a tube, naturally draws out the edges of the flame. The explanation of the matter is very simple. When cold air enters the highly heated shade from beneath, it is suddenly raised in temperature, whereby, and in virtue of its inferior specific gravity, it ascends with considerable velocity along with the products of a partial combustion through the top of the shade, thus a constant current of cold air rushes in at the bottom to restore the equilibrium of atmospheric pressure within it. The result of which is that sufficient time is not admitted for that chemical union which is the result of complete combustion. The edges of the flame also are to some extent folded over, taking the form of two columns, in which is isolated a large amount of carbon from contact with the oxygen of the atmosphere. Consequently the waste of gas in this way is serious, and that in addition to the annoyance of blackened ceilings and a polluted atmosphere.

In my experiments I employed a transparent shade, of the form shown on the sketch, 7 in. diameter, 6 in. high, opening on top 3¾ in., and at bottom 2 in. The burner was the adamas-pointed union jet, as giving the most regularly and beautifully shaped flame of any burner now made. The gases experimented on were ten in number, and these of an illuminating power varying from 10 to 27 candles. An average of 4 feet of gas per hour was consumed of gases over 15 candles, and 5 feet per hour of gases under that value. The following are the results obtained:—

Loss of light by shade and imperfect combustion	12·4 per cent.
Do. by transparent shade only (1-12th in. thick)	7·06 „
Amount of loss due to imperfect combustion	5 34 „

No doubt these results will vary according to the form of shade employed, for if the opening on the top be enlarged, the loss may be greatly diminished. Consequently the bowl form of shade now in use is not so much a gas waster as the other forms referred to. It may here be remarked that the above experiments having been made in a calm external atmosphere, the loss would be very much greater when the latter is in a state of commotion, as then the current through the shade would be accelerated. But I now come to speak of the means by which the whole of the above loss may be more than saved. The idea is not a new one, although when I made the discovery, two years ago, I was not aware that a similar idea had been made the subject of a patent; however, I may, perhaps, claim for an improvement of it. It consists of an ornamental cap or covering set on the top of ordinary glass shades, having a vertical rim, in which a series of openings are made all round to allow the products of combustion to escape.

On looking over the patent list for some years back, I observe that certain patents have been taken out for similar coverings—one for an ornamental covering of glass or china; a second for a covering of wire gauze; another for applying to the top of shades a circular plate of mica or talc, supported on three feet; and again, some months ago, an ornamental covering of terra cotta, or such material as will stand the action of heat well, was patented. A somewhat similar covering, also, has been contrived for the Argand burner by Dr. Faraday, but it was particularly with a view to ventilation. All of these are, no doubt, valuable inventions, and consumers would find them such were they to take advantage of them. They are especially valuable when a certain quantity of gas is consumed, which will be that for which the size of the perforations for the exit of the products of combustion is adapted. I consider it a defect that these openings are of fixed dimensions; an arrangement to control the escape of the products of combustion according to the quantity of gas being consumed by any burner is, in my opinion, of the highest importance. Any simple means may be employed, such as ventilating slides with finger-pins, by which they may be adjusted at pleasure. With more expensive and ornamental shades, such slides may be fitted with screw adjustment. Before proceeding further I may just prove to you, by a very simple experiment, the importance of such a covering being placed on the top of all gas-shades. I shall hold over the shade before you, in which a jet of gas is burning, a sheet of iron, and on bringing it down to a certain point a very marked increase of light will be observed; and it will, at the same time, be observed that the instant such a covering is applied the flame assumes a proper and regular form. By such an application, therefore, to gas-shades, and the means of enlarging or contracting the exit openings, not only may all that is usually lost by imperfect combustion be saved, but even all, and more, than is lost by a transparent shade itself! This may seem strange, yet the results of my experiments indicate a saving of 16 per cent. by such an application to gas-shades of the form shown, or equal to upwards of 11 per cent. greater intensity of light than when the gas is burned in the open air. I am now speaking of the increase of light within the shade; but if from the above we deduct the 7 per cent. of light intercepted by it, we have still nearly 4 per cent. higher illuminating effect on the disc of the photometer than if the gas were under no shade at all—an effect which is, no doubt, caused by the intense heat maintained within the shade. If it be true that light is the result of heat acting on solid matter, I may be right in assigning such augmentation of light to the increase of heat. There can be no doubt as to the importance of such a method of consuming coal gas, and were it adopted I am confident that complaints from smoked ceilings and the so-called "dirty gas" would be unheard of. It may be applied to all shades and lamps, of whatever size or form, as also to oil-lamps, and perhaps to the candle itself. In street-lamps the openings should be adjusted for the maximum quantity of gas burned at any period of the night.

If such an application to shades produces such results, the question naturally arises, ought it not to be employed in all photometrical experiments on cannel gas—a special description of shade being made at one establishment, and sold for the purpose? By the use of such we should have the best possible guide to the complete combustion of the gas, as, should the ventilating openings be too much closed, the flame assumes a yellowish colour; and on these being enlarged until the yellow tinge on the top of the flame has just disappeared, the highest result is then obtained. Imperfect combustion, therefore, cannot take place without the same being most distinctly observable.

When 5 feet per hour of rich gas is made to pass through a burner, a considerable portion of it invariably passes off unconsumed, and for that reason it is found that the highest illuminating power is obtained when from 3·5 to 4·5 feet per hour of Scotch gas is burned, and from 4·5 to 5·5 feet per hour of English gas. If, therefore, the arrangement referred to furnish the means for economically consuming the "standard," as well as any other less quantity of gas, an important end will be gained, even on the assumption that it does no more than recover the amount of light lost from the interception of its rays by the transparent glass shade. And, again, in our photometrical experiments we should be enabled to secure a perfectly steady flame, which is most essential. There is no question but that, to a certain extent, the neglect of the conditions already named, when burning the gas in open air, in the photometer, accounts for the considerable differences that sometimes exist in reports on the illuminating power of gas by different individuals. Much lies, as I have said, in the description of burner employed; therefore care must be exercised in the selection.

Another source of error in estimating the illuminating power of gas lies in the management of the candle. It is a practice with many, when they have made a purchase of standard candles from Wright, of Westminster, or Milne, of Edinburgh, to look upon the weighing of such as unnecessary; or, if once weighed and found to consume the 120 grains exactly, any further weighing of the same candle would be considered a waste of time. Now such a practice cannot be too strongly condemned, as no result can at all be relied on without correctly ascertaining the quantity of sperm consumed, as well as that of the gas during each experiment, even allowing the temperature to be the same when the different experiments are made. The candle or candles should be burned for a few minutes previous to each experiment, and when these become flooded, as is commonly the case, the sperm should be suddenly poured out of the cavity around the wick, and only when in good order should an experiment be proceeded with.

I could have taken up much more of your time on a subject so extensive as the one I have chosen, but such would be imprudent on my part, on such an occasion as the present, when all the business of an annual gathering must be overtaken in a few hours. In conclusion, therefore, if what I have submitted to you, with regard to an improved method of consuming coal gas, induce some men of science, such as our honorary member, Dr. Stevenson Macadam, to examine it and report, I shall be glad. With such I leave it for approval or condemnation, provided, however, that if the latter, it be accompanied with such experimental evidence as shall thoroughly justify the conclusion.

On the reading of these papers much interesting discussion took place amongst the members, and, at the suggestion of the president, a committee was appointed to make investigation as to the practicability of using glycerine along with water for wet gas-meters, as suggested by the paper of Mr. Robb. It was also agreed that the thanks of the meeting be awarded to Messrs. Robb and Hislop for their communications.

Dr. Stevenson Macadam then delivered a lecture on "Coal Gas: the Chemical Principles involved in the Detection and Removal of Impurities." The doctor enumerated the various impurities found in coal gas, and explained their nature and effects upon the quality of the gas itself, and also upon objects with which these might come in contact. He then showed the necessity for their removal, as well as the best means to do so, and illustrated the whole with a series of beautiful and successful experiments.

At the close of the lecture it was unanimously agreed to accord a hearty vote of thanks to Dr. Macadam for his eloquent and instructive lecture.

At the termination of the proceedings the members and a few friends dined together in the Café Royal Hotel, the retiring president occupying the chair.

Obituary.—It is with profound regret we have to record the death of M. Jacques Dubochet, one of the founders of the Paris Gas Company, and a member of its acting managing committee. M. Dubochet was seized with paralysis at Munich, while on a journey undertaken at the suggestion of his friends for the benefit of his health, under which he succumbed there, and was interred in the cemetery of Père Lachaise, Paris, on the 8th inst., amidst the lamentations of an assembly of upwards of five thousand people belonging to all classes of society, including the directors and officers of the gas company and a large circle of scientific and literary notabilities. M. Louis Cuzon, of the *Siècle*, pronounced a warm-hearted and touching eulogy over the remains of his departed friend, which found an echo in every heart, for of Jacques Dubochet it might well be said—

An honest man's the noblest work of God;

and no one had greater opportunities of appreciating his noble character than the writer of this humble but sincere tribute of respect for his memory.

Dr. Hillier's Report on the Gas supplied by the Imperial Company to the Vestry of St. Pancras during the Months of July and August, 1868:—

Date.	Number of Observations.	Average Light in Candles produced by 5 Ft. of Gas per Hour.	Light in Candles reduced to Consumption of 120 Grs. per Hour.	Traces of Ammonia.	Traces of Sulphuretted Hydrogen.
July13	10	13·2	13·2	Yes.	No.
14	10	13·0	13·7	„	„
15	10	13·5	13·5	„	„
23	10	13·0	13·0	„	„
24	10	14·5	14·5	„	„
27	10	13·2	13·2	„	„
29	10	14·4	14·4	„	„
Aug. 3	10	13·0	13·0	„	„
4	10	12·1	12·7	„	„
6	10	12·2	13·4	„	„
24	10	14·2	15·6	„	„
26	10	12·4	13·2	„	„
28	10	12·3	13·5	„	„

The illuminating power of the gas ranged from 12·7 to 15·6 candles. The mean of the 13 days on which the gas was examined by me during the two months was 14·5 candles. Ammonia was present as usual. Sulphuretted hydrogen was absent. The amount of sulphur present in 100 cubic feet was exactly 20 grains.

Gas Explosion at the Bradford Theatre.—This theatre, which is now undergoing alterations and repairs, and is at present occupied by the Haymarket company, was on Wednesday morning the scene of a gas explosion by which Mary Johnson, employed as a cleaner, was burnt about the arms and neck, though, fortunately, not very seriously. A gas-burner in one of the store-rooms had not been turned when the gas was turned off at the main, and when the workmen commenced operations they smelt gas, but its whereabouts could not be discovered. Mary Johnson went into a store-room to obtain a mop and pail, when she ignited a match, and instantly an explosion occurred, blowing her against the door, which was rent from its hinges. The matches in the box she held in her hand were not ignited, and no further injury was done to the room. The poor woman was picked up and conveyed to the infirmary.

Fatal Gas Explosion.—An inquest was held at Stratford New Town, on Thursday last, on the body of Mr. John Bennet, a licensed victualler, who had recently entered into possession of the hotel at the Great Eastern Railway Station at Stratford. On Tuesday evening, observing a smell of gas, he went up to the billiard-room to see what was the matter. His wife followed him, and when they entered the room Mr. Bennet lighted a match. An explosion instantly took place, and the windows were blown out into the roadway, and the doors were also blown away. The alarm created in the neighbourhood was very great, and upon some persons rushing upstairs and entering the room they perceived Mr. and Mrs. Bennet lying on the floor. They were both severely burnt. Mr. Bennet was insensible, and from the first no hopes were entertained that his life would be spared, and he expired on Wednesday afternoon. The injuries received by Mrs. Bennet, although not so severe, have left her in a most precarious condition, and her recovery is doubtful. The evidence of Mr. Carter, a gas-fitter, who examined the premises after the explosion, proved that some gas-fittings had been removed from the centre of the ceiling in the billiard-room, and the service-pipe insecurely plugged with a cork. The coroner sent a messenger to ask Mrs. Bennet whether she could tell when the pipe was taken down. She replied that during Tuesday afternoon the deceased asked her for a cork, and she believed he wanted it to put in the gas-pipe. The coroner having summed up, the jury returned a verdict of "Accidental death," and appended an expression of sympathy with the unhappy widow of the deceased. The coroner said that it would be well for all persons who noticed the smell of gas in a room to open the windows, and let the gas out and the air in. In that way an explosion would be avoided. The accident had occurred through want of caution on the part of the deceased.

THE MARGATE TOWN COUNCIL AND THE GAS COMPANY.—The application of the Town Council for an injunction to restrain the gas company from pumping at their new works in the Dane until October next, was heard before the Lord Chancellor on Friday and Saturday last, and ended in favour of the gas company, much to the annoyance of a very large majority of the inhabitants, many of whom have been deprived of their supply of water, in consequence of their wells being pumped dry by the gas company to enable them to erect their new gasometer.

AVERAGE COMPOSITION AND QUALITY OF THE METROPOLITAN WATERS IN AUGUST, 1868.—The following are the returns of the Metropolitan Association of Medical Officers of Health:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Comps.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	18·13	0·071	0·015	0·010	11·5	2·5
West Middlesex	17·43	0·076	0·011	0·010	11·0	2·5
Southwark and Vauxhall	18·17	0·062	0·012	0·010	12·0	2·5
Chelsea	17·93	0·067	0·023	0·008	11·5	2·5
Lambeth	—	—	—	—	—	—
Other Companies.						
Kent	25·67	0·001	0·083	0·005	17·5	6·5
New River	14·69	0·033	0·049	0·008	11·0	2·5
East London	14·48	0·048	0·028	0·008	10·5	2·0

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and, in the case of the metropolitan waters, the quantity of organic matter is about eight times the amount of oxygen required by it.

All the samples were perfectly bright when drawn from the companies mains.

H. LETHEBY, M.B.

DR. FRANKLAND'S ANALYSIS OF THE METROPOLITAN WATERS IN AUGUST, 1868.—"Royal College of Chemistry, Aug. 27, 1868.—Sir,—I have the honour to submit to you in the following table the results of the chemical examination of the waters supplied to the metropolis during the month of August. For the purpose of comparison I append also the results yielded by Loch Katrine water, as supplied to Glasgow, and by the waters supplied to the towns of Lancaster, Manchester, Leicester, Preston, and Worthing, when submitted to the same analytical processes. With the exception of the Southwark Company's water, the river waters supplied to London again exhibit an exceptional degree of purity as regards solid matter. In August, 1867, the average amount of solid impurity in Thames water was 26·2 parts in 100,000 of water, whilst in the current month it is only (exclusive of the Southwark Company's water) 24·5 parts. The previous sewage contamination is also at present remarkably low; in 1867 it averaged in Thames water 1416 parts in 100,000, whilst in the samples just analyzed it is only 386. On the other hand the proportion of organic nitrogen, representing chiefly unoxidized animal impurities, is as great as usual, averaging for Thames water exactly the same in August, 1867, and August, 1868—viz., ·025 part in 100,000 parts of water, showing that the accelerated oxidation of the organic impurities, owing to the high temperature, is nearly compensated by the diminished volume of water with which the sewage and manure matters commingle in the Thames and Lea. The Southwark Company's water contains an exceptionally large amount of mineral matter, causing the total solid impurity to rise to 30·2 parts in 100,000. The high temperature of the river waters as delivered in London during July still prevailed on the 14th and 19th inst. The water delivered by the Chelsea and Southwark Companies was very slightly turbid, whilst that of the East London Company presented an opalescent or milky appearance. The rest of the waters were clear and transparent.

Companies.	Date and Place of Collection.	Temperature in Cent. Degrees.	Total Solid Impurity in 100,000 Parts.	Organic Carbon.	Organic Nitrogen.	Nitrogen, as Nitrates and Nitrites.	Ammonia.	Total combined Nitrogen.	Previous Sewage Contamination (Estimated).	Total Hardness.
Thames.	Temp. of Thames —Aug. 14	Cent. 18·55								
Chelsea	Aug 14—Cab Rank, Horse Guards	19·4	24·8	·154	·021	·069	·001	·091	380	19·4
West Middlesex	Aug 14—Cab Rank, Portland Road	20·5	24·0	·133	·029	·044	·000	·073	120	19·2
Southwark & Vauxhall	Aug 19—Cb. R., St. George's Ch., Bo.	20·2	30·2	·111	·023	·089	·001	·113	580	18·2
Grand Junction	Aug 14—Cab Rank. Woodstock St.	18·9	24·2	·137	·020	·064	·001	·085	330	19·2
Lambeth	Aug 14—Cab Rank, Lambeth Road.	19·4	25·2	·168	·030	·084	·000	·114	520	19·4
Other Sources										
New River	Aug 14—Cab Rank, Tottenham Ct. Rd.	20·5	24·0	·068	·017	·087	·001	·105	560	19·2
East London	Aug 15 — Slater's, Old Ford Road	18·9	21·2	·115	·022	·004	·001	·027	0	15·1
Kent	Aug 14— Deptford Bdge. Police Stat.	13·9	40·2	·046	·006	·398	·000	·404	3660	27·1
Loch Katrine	July, 1867, Glasgow		3·0	·161	·011	·000	·001	·012	0	0·3
Lancaster	Sept.—Lancaster		3·54	·157	·001	·036	·001	·038	50	0·1
Manchester	June—Manchester		6·2	·183	·009	·025	·006	·039	0	3·7
Leicester	Nov.—Leicester		23·7	·506	·020	·001	·001	·022	0	13·4
Preston	Dec.—Preston		14·7	·515	·040	·001	·003	·044	0	6·7
Worthing	Nov.—Worthing		36·7	·162	·000	·426	·000	·426	3940	23·8
Column 1	2	3	4	5	6	7	8	9	10	11

The numbers in columns 4, 5, 6, 7, 8, 9, 10, and 11 all relate to 100,000 parts of the waters. The table is to be read thus: The Chelsea Company's water collected on Aug. 14, at the Horse Guards cab rank, had a temperature of 19·4° Cent.; 100,000 lbs. of it contained 24·8 lbs. of solid impurity; the organic matter, constituting a portion of this impurity, contained ·154 lb. of carbon and ·021 lb. of nitrogen. This solid impurity also contained ·069 lb. of nitrogen in the form of nitrates and nitrites, besides ·001 lb. of ammonia; whilst the total amount of *combined* nitrogen in every form was ·091 lb. The above quantity of water supplied by the Chelsea Company had been, after its descent to the earth as rain, contaminated with sewage or manure matter equivalent to 380 lbs. of average filtered London sewage. By gradual oxidation, partly in the pores of the soil, partly in the Thames and its tributaries, and partly in the reservoirs, filters, and conduits of the company, this sewage contamination had been converted into innocuous inorganic compounds before its delivery to consumers. Finally, 100,000 lbs. of the Chelsea Company's water contained 19·4 lbs. of carbonate of lime, or an equivalent quantity of other soap-destroying ingredients.—I have, &c., E. FRANKLAND.—The Registrar-General, &c."

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	NAME OF COMPANY.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Price per Share.
	£		£ s. d.	£ s. d.	£
8000	10	Anglo-Romano	10 0 0	10 0 0	11 — 12
5000	20	Bahia (Limited)	20 0 0	3 0 0	14 — 15
1000	20	Do., preference	20 0 0	10 0 0	20 — 22
750	20	Do., do., redeemable	20 0 0	10 0 0	20 — 21
40000	5	Bombay (Limited)	5 0 0	4 10 0	3⅜ — 4
10000	5	Do., third issue	3 0 0	4 10 0	1¼ — 2
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge, & Holywell.)	20 0 0	10 0 0	28 — 29
12000	50	*Chartered*	50 0 0	7 0 0	54 — 56
6000	50	Do.	45 0 0	7 0 0	47 — 49
10000	20	*City of London*, A shares	20 0 0	9 0 0	24 — 26
10000	10	Do., B shares	10 0 0	4 0 0	6 — 6¼
9629	10	Do., new shares	10 0 0	9 0 0	12 — 13
25000	25	City of Moscow (Limited)	25 0 0	nil.	5½ — 6¼
17490	25	*Commercial*	25 0 0	10 0 0	36 — 38
20000	20	Continental Union	20 0 0	4 0 0	15¾ — 16¼
10000	20	Do., preference	20 0 0	7 0 0	20 — 20¼
5000	10	*Crystal Palace District*	10 0 0	10 0 0	14 — 15
5000	10	Do., preference	10 0 0	6 0 0	12½ — 13
10000	10	Do., new shares	2 10 0	7 0 0	2½ — 3
4000	50	*Equitable*	50 0 0	10 0 0	70 — 72
4000	25	Do., new shares	25 0 0	10 0 0	35 — 36
23406	10	European (Limited)	10 0 0	11 0 0	15 — 15½
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	11 0 0	7¼ — 7¾
20000	10	*Great Central Gas Consumers*	10 0 0	10 0 0	14 — 14¼
5000	10	Hong Kong (Limited)	10 0 0	5 0 0	8 — 10
26000	50	*Imperial*	50 0 0	10 0 0	70 — 72
26000	10	Do., new shares	1 0 0	10 0 0	1⅞ — 2
26000	12½	Do., new shares	3 0 0	7 0 0	3¼ — 3⅞
1300	100	Do., bonds	£100	10 0 0	175 —180
28000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	16 0 0	99¼—101

Number of Shares issued.	Amount per Share.	NAME OF COMPANY.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Price per Share.
	£		£ s. d.	£ s. d.	£
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	52 — 53
3000	10	Do.	10 0 0	5 0 0	7 — 9
3000	20	Do.	12 10 0	7 10 0	13 — 14
7133	50	*London*	50 0 0	10 0 0	66 — 68
5610	25	Do., 1st preference	25 0 0	6 0 0	26 — 28
503	50	Do., 2nd preference	50 0 0	6 0 0	
214	50	Do., 3rd preference	50 0 0	6 0 0	
£18781		Do., 1st preference stock		6 0 0	
£11828		Do., 2nd preference stock		5 0 0	
12000	5	Malta and Mediterranean (Limited)	5 0 0	5 0 0	3½ — 4
6000	5	Do., preference	5 0 0	7 0 0	.. — 5
30000	5	Oriental (Calcutta)	5 0 0	9 0 0	6¾ — 7¼
30000	5	Do., new shares	1 0 0	9 0 0	1⅞ — 1⅝
10000	5	Ottoman (Limited)	5 0 0	nil.	1⅝ — 2¼
10000	10	Pará (Limited)	10 0 0	6 0 0	8½ — 9
27000	20	*Phœnix*	20 0 0	10 0 0	29 — 30
3600	100	Do., new	35 0 0	7 10 0	37 — 38
144000	8k.	Do.	100 0 0	5 0 0	75 — 77
5000	20	*Ratcliff*	20 0 0	10 0 0	23 — 25
	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	23 — 25
6959	5	Singapore (Limited)	5 0 0	4 0 0	
2000	5	Do., preference	5 0 0	7 10 0	
		Shanghai			
4500	50	*South Metropolitan*	50 0 0	10 0 0	73 — 75
	12½	Do., new shares	12 10 0	10 0 0	18 — 19
15000	10	*Surrey Consumers*	10 0 0	10 0 0	13¾ — 14¼
10000	10	Do., new	6 0 0	10 0 0	8 — 8½
9000	5	United General (Limerick)	5 0 0		2 — 2¼
10000	10	*Victoria Docks*	5 0 0	6 0 0	
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	10 — 12
2989	10	Do.	10 0 0	7 10 0	10 — 10½
316	10	Do.	6 10 0	7 10 0	
1128	10	Do.	3 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	14 — 15
10000	10	Do., B shares	6 0 0	10 0 0	8 — 9
10000	10	Do., C shares	6 0 0	10 0 0	8 — 9
20000	10	Do., D shares	1 0 0	10 0 0	1½ — 2
8000	5	*West Ham*	5 0 0	7 10 0	.. — 7½
6000	5	Do., new shares	5 0 0	7 10 0	.. — 7½
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1½ in.	2 in.	2½ in.	3 in	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Pig Iron, No. 1 (g.m.b.)	3 12 6	3 13 10½	2 6 6	3 5 0	3 5 0
1¼ and 2-inch Socket-pipes	7 10 0	8 0 0	6 15 0	6 15 0	7 10 0
2½ and 3-inch ditto	7 0 0	6 0 0	6 5 0	6 10 0	7 0 0
4 and 5-inch ditto	6 10 0	5 10 0	5 15 0	6 0 0	6 10 0
6 inches and upwards ditto	6 5 0	5 0 0	5 10 0	5 15 0	6 5 0
Retorts, 1st fusion, hot blast	6 0 0	—	5 5 0	5 10 0	6 0 0
Ditto, 2nd ditto, cold ditto	7 0 0	5 15 0	5 15 0	6 0 0	7 0 0
Tank-plates, ¼ thick and above	6 10 0	5 10 0	5 10 0	5 15 0	6 5 0

WROUGHT-IRON TUBING,

Subject to 50 per cent. Discount.

	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 12 feet—per foot	1 8	1 0	0 10	0 7	0 5	0 4½
Ditto ditto, from 6 inches to 18 inches—each	3 0	2 0	1 9	1 3	1 0	0 9
Connecting-pieces, or Long Screws	3 6	2 3	2 0	1 6	1 2	0 11
Bends, Springs, and Elbows (wrought iron)	3 9	2 3	1 9	1 0	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 10
Crosses, ditto	4 6	3 0	2 6	2 0	1 6	1 2
Iron Cocks	17 6	9 6	7 6	4 6	3 3	2 6
Ditto, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Nipples	1 3	0 9	0 8	0 6	0 5	0 4
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 3-quart	15 0	14 0	13 6	13 0	12 0	—

GAS COALS.—*Per Ton.*

Newcastle.—Unscreened:—	
Haswells, Nettlesworth Primrose, and South Pelaw	6s. 6d.
Felling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	6 9
Burnhope, Craghead, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton.	7 0
Peareth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Peareth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	15 0
Wigan Cannel (at Liverpool)	17 0
Scotch Cannel:—	
Boghead (at Leith)	42 6
Muirkirk	27 0
Kirkness, best (at Burntisland)	28 6
Capeldrae, 1st quality (at ditto)	28 6
Ditto, 2nd ditto (at ditto)	18 6
Cowdenbeath	12 0
Leamahago (at Glasgow)	31 6
Ditto (at Granton)	32 6
Arniston	27 6
Wemyss (f.o.b.)	22 6
Haywood, Wilsontown (at Granton)	23 0
Pirnie, or Methill	17 0
Lothian's Cannel (at Leith)	28 0
Myles' Cannel	23 6
Lochore Parrot (at Burntisland)	28 0
Lanemark (at Glasgow)	16 0
Elphinstone Tower (at Leith)	20 0
Coppa Cannel (on rails at Birkenhd.)	14 9
Ditto ditto (ditto at Connah's Quay)	14 3

FREIGHTS.

Coastwise—Newcastle.—Per Ton:—	
Chatham and Rochester	5s. 6d. to 5 7½
Cork	7s. 6d. to 8 0
Dover, Folkestne, & Ramsgate	6 0
Dublin	8s. to 8 6
Exeter Quay	7 6
Ipswich	4 6
London (from Leith)	7s. 6d. to 8 0
London (Pool)	6 0
Lowestoft and Yarmouth	4 6
Portsmouth & Southampton	6 3
Plymouth	6s. 9d. to 7 0
Shoreham	6 0
Whitstable	5 6
Weymouth	6 6
Foreign.—Per Keel:—	
Barcelona	£17 10
Bordeaux	£12 to 12 10
Boulogne and Calais	£6 5s. to 6 10
Cadiz	13 10
Cronstadt	—
Copenhagen	£9 to 8 5
Genoa	16 0
Hamburg	7 15
Havre de Grace	8 0
Leghorn	17 0
Lisbon	£11 10s. to 12 0
Rotterdam	7 5
Stettin	10 0
Trieste	14 10
Venice	19 0

SUNDRIES.

Best Natle. Fire-bks., p. 1000, £2 10s. to	£2 15 0
Cliff's Fire-bks. (at Wortley), p. 1000	2 15 6
Ingham's ditto (at Wortley), p. 1000	2 15 0
Farnley Iron Co.'s Fire-bks. (at Wortley), less discount	2 17 0
Fire-clay Retorts, p. ft. run, 5s. 6d. to	0 7 0
Tough Cake Copper, p. ton	72 0 0
English Pig Lead, p. ton	18 15 0
Welsh Bar Iron (in London), p. ton	6 10 0
Foreign Spelter, p. ton	20 0 0
English Block Tin, p. ton	96 0 0
Banca, p. ton	92 0 0
Tarred Rope Yarn, p. cwt.	1 0 0

Advertisements.

C. A. S. VICKARY,

(ADMINISTRATRIX TO THE LATE JOHN VICKARY,)

GAS ENGINEER AND CONTRACTOR, IRON AND BRASS FOUNDER,

EXE ISLAND, EXETER,

Tenders her best thanks to the various Gas Companies in **England, Ireland, and Wales,** for the very liberal and kind support received by her lamented husband for the last **22 years,** during which period he erected and extended more than **200 Gas-Works.** She respectfully solicits a continuation of that support, and begs reference to the following testimonial:—

Plymouth and Stonehouse Gaslight Company.

Sir,—I have much pleasure in testifying that the 100-foot Telescope Gasholder and Cast-Iron Tank, erected by you for this Company in 1862, has given the highest satisfaction, and never required the slightest alteration or adjustment since its completion.

Mr. John Vickary. (Signed) PETER ADAMS, Chairman.

The late Mr. Vickary also erected a 100-foot Gasholder and Cast-Iron Tank at **Exeter;** an 80-foot Telescope Gasholder and Iron Tank at **Devonport;** a 90-foot at **Torquay,** &c., &c. At either of these works satisfactory references can be made.

C. A. S. V. begs particular attention to her **Improved Gas-Meters,** both **Wet and Dry,** the materials and workmanship of which are guaranteed of the very best description, and which have gained for her Meters so excellent a reputation.

RETORTS, DIP & ASCENSION PIPES, HYDRAULIC MAIN, CONDENSERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, and GASHOLDERS,

Of any size, and every description of article required in Gas-Works supplied.

Mains, Tees, Connexions, and Syphons, from 2 to 12 in., always in stock, and supplied at Scotch prices.

Clay Retorts and Fire-Goods of every description.

Chandeliers and Gas-Fittings of the most modern designs.

Iron Pipe and Fittings, Service Cocks, &c.

Plans, Specifications, and Estimates for the Erection of New Gas-Works of any size furnished.

EDGE'S AMERICAN PATENT METHOD FOR SCURFING RETORTS.

The above improved method having been found to be the most efficacious, expeditious, and economical of any plan at present employed for the removal of the Incrustation from the interior of Retorts, arrangements have been made with the Patentee for working the patent in this country. Particulars and Terms for Licences may be had on application to

E. GODDARD, GAS-WORKS, IPSWICH,

Where the process may be seen in full operation.

TO IRONMASTERS, IRONFOUNDERS, AND OTHERS.

THE Directors of the Chartered Gas Company are prepared to receive TENDERS for the manufacture and delivery of about

14,000 Tons of MAIN-PIPES and CASTINGS,

in accordance with drawings and a specification, copies of which, with all other necessary information in relation thereto, may be obtained on application at this office.

Tenders are to be sent in to me on or before Friday, the 18th of September inst., endorsed "Tender for Pipes."

The Directors do not bind themselves to accept the lowest or any Tender.—By order,

JOHN ORWELL PHILLIPS, Secretary.

Chartered Gas Company, Horseferry Road, Westminster, Sept. 8, 1868.

TENDERS FOR GAS TAR.

THE Birmingham and Staffordshire Gaslight Company are prepared to receive TENDERS for the purchase of their GAS TAR, from the works at West Bromwich, Saltley, and Adderley Street, Birmingham, from and after the 1st of January next.

Particulars as to quantities, &c., may be obtained from the Secretary.

Tenders to be sent in on or before the 1st day of October next, addressed to the Secretary, "Tender for Gas Tar." Security for the due performance of the contract will be required.

SAMUEL WALSH, Secretary.

Old Square, Birmingham, Sept. 2, 1868.

GAS TAR.

THE Directors of the Gravesend and Milton Gaslight Company are ready to receive TENDERS for the purchase of their surplus TAR and AMMONIACAL LIQUOR for One year or Three years from the 29th day of September inst. The quantity of Tar will be about 40,000 gallons, and the quantity of Liquor about 50,000 gallons per annum. The Company will load into the Contractor's barges.

Any further particulars may be obtained on application at the works at Gravesend.

Tenders, marked "Tender for Tar, &c.," to be sent to our Office, 4, Edwin Street, Gravesend, on or before the 30th day of September inst.

SOUTHGATE AND SON, Secretaries.

Gravesend, Sept. 9, 1868.

SURREY CONSUMERS GAS COMPANY.

NOTICE is hereby given that the HALF-YEARLY ORDINARY GENERAL MEETING of the SHAREHOLDERS of this Company will be held at the Bridge House Hotel, London Bridge, on THURSDAY, the 8th day of October next, at Three o'clock in the afternoon precisely, to receive the Directors Report for the half year ending the 30th of June last, and to declare a Dividend.

The Books for the Transfer of Shares will be closed on Saturday, the 26th of September, until after the Meeting. W. P. BODDY, Secretary.

Rotherhithe, Sept. 1, 1868.

SOUTH METROPOLITAN GAS-LIGHT AND COKE COMPANY.

NOTICE is hereby given that an ORDINARY MEETING of the PROPRIETORS of this Company will be held at the London Tavern, in the City of London, on MONDAY, the 5th day of October next, at Two o'clock precisely, to receive the Directors Report, and the Accounts of the Company for the half year ended June 30 last, and to declare a Dividend to the same period.—By order,

THOMAS LIVESEY, Secretary.

Old Kent Road, Sept. 12, 1868.

PHŒNIX GASLIGHT and COKE COMPANY.

NOTICE is hereby given, that the adjourned HALF-YEARLY GENERAL MEETING of PROPRIETORS holding previous to Midsummer last £300 paid-up capital and upwards in the said Company, will be held, pursuant to the Act of Incorporation, on WEDNESDAY, the 14th proximo, at Twelve for One o'clock, at the Bridge House Hotel, in the Borough of Southwark, for the purpose of declaring Dividends to Midsummer last, and on other business.

By order of the Court of Directors,

ISAAC ADOLPHUS CROOKENDEN, Secretary.

70, Bankside, London, S.E., Sept. 14, 1868.

IMPORTANT TO GAS AND WATER COMPANIES.

CAST and Wrought Iron Main and Service Pipes and Fittings effectually preserved from Oxidation by

HICKMOTT'S PATENT METHOD.

For particulars apply by letter to J. HICKMOTT, 12, Grove Terrace, Grove Road, St. John's Wood, LONDON.

NOTICE OF REMOVAL.

THOMAS GLOVER and CO. beg to inform gas companies and others that they have removed to their new and more commodious premises, 214 to 222, ST. JOHN STREET, CLERKENWELL GREEN (within two minutes' walk of their old premises), where they shall have increased facilities for executing any orders with which they may be favoured.

They take this opportunity of returning thanks for past orders, and to assure them that they shall continue to manufacture their Meters of the best materials and workmanship, thereby maintaining the well-known high character which their Meter has always had.

SWANWICK CANNEL COAL.— The attention of Gas Companies is called to the following analysis of the Swanwick Cannel Coal by William Fiddes, Esq., Bristol.

Analysis of Swanwick Cannel Coal.

Specific gravity of the Coal	1·271	
Fixed products	54·750	per ct.
Volatile products	41·750	,,
Sulphur in the Coal	1·318	,,
Ash in the Coal	3·500	,,
The quantity of purified gas per ton was	10,651	cub. ft.
Sulphuretted hydrogen in the crude gas	1·39	per ct.
Carbonic acid in ditto	3·58	,,
Matter condensable by bromine in the purified gas	11·20	,,
Carbonic oxide ditto	6·50	,,

The illuminating power of the gas, when burned in a bat's-wing burner at the rate of 4 cubic feet per hour, was equal to a light of 20·15 spermaceti candles, each burning 120 grains per hour.

The heating power of the Coal is 13·75, or 11b. of this Coal, by its perfect combustion, will convert 13·75 lbs. of boiling water into steam.

Ultimate Analysis.

Carbon	74·316	per cent.
Hydrogen	6·285	,,
Oxygen	14·201	,,
Nitrogen	0·350	,,
Sulphur	1·318	,,
Ash	3·500	,,
	100 000	,,

WILLIAM FIDDES, F.C.S.

Gas-Works, Bristol, May 28, 1868.

All orders to be addressed to Mr. HENRY BOAM, Head Office, 1, Darwin Terrace, DERBY.

SWANWICK CANNEL COAL.— The following analysis of this Coal has been made and reported by W. Valentin, Esq., of the Royal College of Chemistry, London:—

Chemical Composition of Coal.

(Mean of two well concordant experiments.)

	In 100 parts.
Water given off at 212° Fahr.	5·80
Carbon	73·90
Hydrogen	5·00
Oxygen	9·05
Nitrogen	1·41
Sulphur	1·47
Ash (white)	3·37
	100·00

Coke—53·3 per cent.	
Ash in coke	6·72
Combustible carbonous matter	93·28
	100·00

Volatile carbonous matter (inclusive of 5·8 per cent. of water, of 1·41 per cent. of nitrogen, and part of the sulphur in the coal)	46·70
Fixed carbonous matter left in the coke	49·93
Ash	3·37
	100·00

The Coal yielded 11,200 cubic feet (per ton) of gas, the average of four distillations, conducted at the experimental gas-works of the Chartered Gas Company, at Horseferry Road, Westminster.

The quality of the gas was very good; burnt by means of the usual standard bat's-wing burner, consuming 5 cubic feet of gas per hour, its mean illuminating power, deduced from thirty trials, was found to be equal to that of 23·98 candles, the candles consuming 120 grains of sperm per hour.

The coke which was left was of the same compact nature as the Coal itself. The small per centage of ash raises its value much above that of the coke obtained from the ordinary Cannel Coal.

The coke will form a good fuel when mixed with other more porous coke, or by itself, in a smith's fire. Thus the objection generally raised by gas companies with respect to coke from Cannel Coal will scarcely apply to this coke.

My opinion, based upon the results of my analysis, is that *this Cannel Coal is a very valuable Coal for gas purposes*, and that it will find a ready market.

(Signed) W. VALENTIN,
Aug. 3, 1865. Sen. Assistant.

All orders to be addressed to Mr. HENRY BOAM, Head Office, 1, Darwin Terrace, DERBY.

OLD WEMYSS CANNEL COAL.— Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to Mr. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

CANNEL COAL.—The West York-shire Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Huggon, Esq., F.C.S.:—

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz—

Yield of gas.	10,416 cubic feet.
Illuminating power	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas.	10,080 cubic feet.
Illuminating power	14·41 sperm candles.
Yield of Coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

CANNEL COAL.

MESSRS. GRIFFITHS BROTHERS, COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their Cannel for gas-making purposes.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to GRIFFITHS BROTHERS, Coppa Colliery, Mold, FLINTSHIRE.

WANTED, by the Sheffield United Gaslight Company, a steady, active FOREMAN of gas-fitters. He must be thoroughly qualified to plan out and fit up the interior of large works and gentlemen's houses; also capable of superintending the entire work (in lead and iron) connected therewith.

Apply, in own handwriting, with age, salary required, and reference, to Mr. E. UNWIN, the Managing Director, 19, Shude Hill, SHEFFIELD.

PARTNERSHIP.—Sleeping Partner wanted, in a well-established Gas Products Manufacturing Business.

Address "PARTNER," care of M. C. Bellamy, Esq., Solicitor, 6, Wormwood Street, LONDON.

WANTED, a re-engagement as MANAGER of gas-works. Can fix retorts, lay mains and services, fix meters, and take indices. Thoroughly understands all the general duties required in a gas-work. Age 30, married, no children. No objection to go abroad. Good references.

Address D. D., 2, Upper Salisbury Street, Maida Hill, LONDON, N.W.

WANTED, a re-engagement as MANAGER of a country gas-work (with or without exhauster); 20 years experience. Is thoroughly acquainted with the working and setting of clay or iron retorts; also with alterations or erection of works.

Testimonials from past or present employers.

Address "WIGAN," care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a re-engagement as MANAGER of a gas-work. Is thoroughly experienced in all gas matters, retort-setting, fixing, gas work, gas-fitting, and all the general duties required in a gas-work.

For reference, &c., apply to W. W. ARCHIBALD, Esq., Chairman to the Knighton Gas Company, RADNORSHIRE; or to S. BARK, Knighton Gas-Works.

TO GAS COMPANIES.

WANTED, by the Advertiser, a situation as SECRETARY and MANAGER. Good experience in the manufacture and distribution of gas, retort-setting, main and service laying, gas-fitting, &c. Well acquainted with accounts. Good testimonials and references.

Address ALFRED, 7, Salisbury Street, Stepney, LONDON.

WANTED, by the Advertiser, a situation as UNDER MANAGER or INSPECTOR. Has had eight years experience in gas-works.

Address A. B., Gas-Office, SUNDERLAND.

A PRACTICAL Gas Engineer is desirous of an engagement as INSPECTOR, or Manager and Fitter to a small works. Age 28.

Address K. T., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS AND WATER COMPANIES.

WANTED, by the Advertiser, a situation as MAIN and SERVICE LAYER. Good reference can be given.

Address G. N., 44, Post-Office, Great Malvern, WORCESTERSHIRE.

WANTED, a situation as Valveman or METER FIXER, and to make himself generally useful in a large or small gas-work. Six years in the last situation.

Address J. K., 8, Vincent Street, LIMEHOUSE.

WANTED, by a Gas-Fitter, a situation in the country. Is experienced in both interior fitting and service-laying, and can give first-class references.

Address T. E., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS-FITTERS.

WANTED immediately, a young man as GAS-FITTER, &c. Applications, stating wages required and with references, to be sent to the MANAGER, Gas-Works, ABINGDON.

FOR SALE.

THE Monaghan Gas Company, Limited, have FOR SALE Two PURIFIERS, each 4 ft. by 4 ft. by 2 ft. 6 in. deep, with wrought-iron covers, and 4 tier wrought-iron grids; One Centre-Valve, with 5-in. connexions for 2 purifiers. Also One Washer, 6 ft. by 3 ft. by 22 in. high. All the above being removed to make room for larger.

Proposals to be addressed to

JOHN HOLMES, Manager and Secretary.

NATURAL
HYDRATED OXIDE of IRON
constantly on Sale. Apply to
MARTYN DENNIS AND CO.,
LIVERPOOL.

F. SIMMONDS, Senr.,
221, KINGSLAND ROAD,
RETORT & BOILER SETTER
For the Chartered Gaslight Company, Brick Lane and Curtain Road Stations, and numerous Gaslight Companies, London and Provincial.
NO CONNEXION WITH ANY OTHER RETORT SETTER.
Estimates given with or without materials.

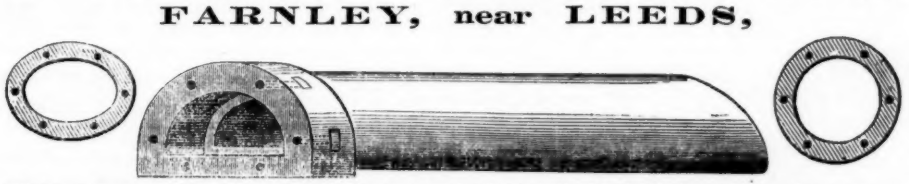
OXIDE OF IRON,
We are prepared to supply, on moderate terms,
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given satisfaction.
FRANCIS RITCHIE & SONS,
BELFAST.

Mr. H. GORE,
CONSULTING GAS ENGINEER,
20, ALFRED PLACE, BEDFORD SQUARE, LONDON, W.C.

TO EXPORTERS OF GAS COAL.
THE PATENT GAS COAL yields 13,800 feet of 32-candle gas, saves 33 per cent. in lime purification, and yields a good coke. Shipped, f.o.b., Rotterdam, at 23s. per ton.
Apply to HAMILTON, DULLENS, and Co., DORDRECHT, Patentees for England, France, Holland, Denmark, and Germany; or to their London Agents, WARNER, WALDUCK, and Co., 11, OLD JEWRY CHAMBERS.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS, &c. &c.
SCOTSWOOD FIRE-BRICK WORKS,
NEAR
BLAYDON-ON-TYNE.

THE FARNLEY IRON COMPANY,
FARNLEY, near LEEDS,



In consequence of the increasing demand for their Retorts, have largely extended this branch of their Fire-Clay Works, and are now prepared to execute the most important orders, either for *home* or *export*, with great punctuality.
The Fire-Clay raised from the Farnley Estate (commonly called the Wortley bed) is unsurpassed by any other known in the district, and is peculiarly well adapted for Retorts, Gas-Ovens, and Fire-Bricks; and the F. I. Co. beg especially to invite those connected with Gas-Works, who have not yet used their Retorts, to be good enough to favour them with a trial.
The F. I. Co. generally hold in stock, for immediate supply, Fire-Bricks of every size and kind—Tiles, Sanitary Tubes, Ornamental Terra-Cotta Ware White Facing Bricks, the White, Buff and Salt-Glazed Bricks, &c., &c.
Prices, Drawings, and all other information may be obtained by applying as above, or to

MR. SUTTON, THE HULL STORES, 46½, QUEEN STREET, HULL.

TO CORPORATIONS, GAS ENGINEERS, AND OTHERS.

HENRY ALDER,
GRANGE METER-WORKS, EDINBURGH,

Begs to intimate that he is the ORIGINAL MANUFACTURER of

DRY GAS-METERS IN CAST-IRON CASES.

The Meters are protected by Registration on the 17th of December, 1864, under the "Copyright of Designs Act."
They are much more durable, and at the same time more easily repaired than those in Tin Cases.
PRICE LIST AND TERMS ON APPLICATION.
Agent for Ireland—Mr. J. FURNESS, 3, Fownes Street, DUBLIN.

BEST AND HOLDEN'S
PATENTS FOR CHARGING AND DRAWING GAS-RETORTS,
WITH CHAMBERS FOR MOUTHS,
REQUIRING NO LUTING.

Gas Engineers are solicited to examine into the merits of this invention before erecting new or altering old retort-houses. It may be seen in action at the Alliance Gas Company's Works, Dublin, where its utility and economy will be clearly demonstrated. Although the saving in labour will be considerable, and quickly return any outlay of capital, there are other and important features strongly recommending its adoption at all gas-works, and which a gas engineer upon examination will at once appreciate.
The Directors of the Alliance Gas Company have kindly consented to give every facility to gentlemen desirous of seeing the invention in operation. Parties, therefore, about to visit Dublin will be so good as to send us their card, and we will furnish them with letters of introduction.
Drawings, &c., may be seen at our Office, and all details explained.

JOHN CHISHOLM, SON, & CO., 44, MARK LANE, E.C.

ECONOMY IN GAS PURIFICATION.
Mc DOUGALLS'
HYDRATED PEROXIDE OF IRON.

This Oxide is now well known, and has gained at a number of the largest gas-works at home and abroad a decided preference for efficiency and durability. It is free from any mixture of sawdust or other material, every particle being available for use, thus causing the Purifiers to work double the time before it requires renewing, and saves one-third the cost of labour in charging them. It readily takes up sulphur, revivifies rapidly, and lasts longer than any other Oxide in the market. Prices on application to—

Mc DOUGALL BROTHERS, Manufacturing Chemists,
LONDON—11, Arthur Street West, London Bridge, E.C.; MANCHESTER—Riga Street, Shudehill.

CATHELS'S Patent Dry District GOVERNOR is the only perfect self-acting contrivance for regulating the pressures in the higher levels of a district.

CATHELS'S Patent Four-way Disc GAS-VALVE—ONE OF WHICH SERVES AS THREE ORDINARY VALVES—is the best Valve for gas-works.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS'S Patent Ribbed Gas Main-PIPES cost but about 1d. to 2d. per yard (depending on the size) more than Plain Pipes, and ensure PERFECT GAS-TIGHT CONNEXIONS with the Service-Pipes.
Apply to Messrs. BEGGS & SON, 37, Southampton Street, Strand, LONDON.

TESTIMONIAL.

Abingdon Gaslight and Coke Company, Limited, Offices and Works, Thames Street, June 25, 1868.

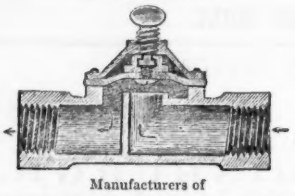
Mr. E. S. CATHELS.

Sir,—We have recently relaid a great portion of our town with your Patent Pipe, and I have much pleasure in bearing testimony to its merits. I find from our fitters that there is not the tendency to split when large services are put in that we find in the ordinary pipe of the smaller sizes, and, from having a greater thickness to drill and tap into, there is less liability to leakage at the connexion.

I am, sir, yours respectfully,
JOHN TOMKINS, Chairman.

THOMAS LAMBERT & SON,
SHORT STREET, LAMBETH, LONDON.

CARTER'S SAFETY GAS-VALVES,
Made to suit every Description of Fittings.
Section of Valve open.



Manufacturers of
WROUGHT-IRON PIPES AND FITTINGS,
SLUICE-VALVES & STOP-COCKS,
STOCKS, TAPS, AND DIES,
CHANDELIERS, PENDANTS, &c.
PATENT MERCURIAL GAS-REGULATORS.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Office in London, Mr. E. M. PERKINS, 78, Lombard Street.

HENRY F. WILLEY,
(Manager for the late Mr. Vickary, of Exeter, 15 years,)
GAS ENGINEER AND CONTRACTOR.
WORKS: BARTHOLOMEW STREET, EXETER.

Improved Wet and Dry Meters. Gas Apparatus and Gas-Fittings Manufacturer.
Contractor for the Erection of Gas-Works, Gasholders, Station-Meters, Governors, and every article and apparatus appertaining to Gas-Works.

A GREAT SAVING OF TIME, LABOUR, & EXPENSE
IS EFFECTED BY THE USE OF
PRICE'S
PATENT COAL AND COKE BARROWS.

In addition to other testimonials the following has recently been received from one of the largest Gas Companies in London :—

London Gaslight Company, Nine Elms, May 18, 1868.

Dear Sir,—The Patent Coke Barrows are a great improvement, and a saving both in time and labour.
Yours truly, D. WATSON.

They are in use in the Government, Metropolitan, and several country Gas-Works.

Manufacturers for London and South of England—PRIEST & WOOLNOUGH, KINGSTON-ON-THAMES.
Manufacturers for the Midland Counties and North of England—
THE COALBROOKDALE COMPANY, NEAR WELLINGTON, SALOP.
Manufacturers for Ireland—J. EDMUNDSON AND CO., CAPEL STREET, DUBLIN.

Communications to be addressed to the Sole Agent, R. E. KEEN, 50, Claremont Road, Surbiton, S.W.; or either of the above.

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MANUFACTURERS OF
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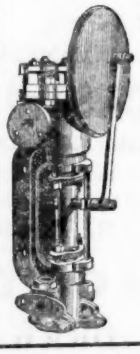
INJECTORS, SAFETY-VALVES, STOP-VALVES, AND BOILER MOUNTINGS
OF EVERY DESCRIPTION.



Special attention is called to their New Improved Donkey Pumps, which are the best boiler feeders yet brought before the users of steam power. For boilers supplying steam to apparatus other than a steam-engine they are indispensable, and are rapidly supplanting the use of the feed-pump in the engine. They are also largely used in gas-works for pumping ammoniacal liquor, &c., in all parts of the world.

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No. 4	1¾ Inch.	2¼ Inch.	150	10	£6 10 0
5	1½	3	230	15	8 10 0
6	1¾	4	460	30	11 0 0
7	2	4	600	40	13 0 0
*8	2	4	900	60	15 10 0
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TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.
FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

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MANUFACTURED BY
WILLIAM AND BENJAMIN COWAN,
(ESTABLISHED 1827,)
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COWAN'S PATENT SIDE-VALVE GAS-METERS.

PATENT ANTIMONY PAINT.

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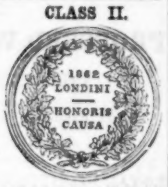

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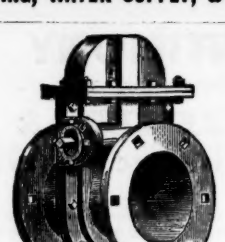

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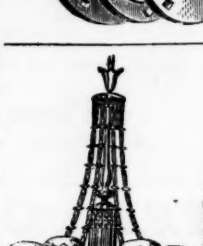

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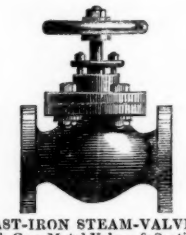
1 ,,	0 6 0
1¼ ,,	0 8 6
1½ ,,	0 11 0
1¾ ,,	0 14 0
2 ,,	0 18 0
2½ ,,	1 2 6



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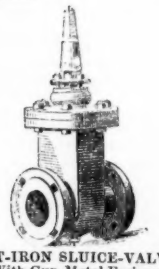
3 ,,	1 17 6
4 ,,	2 15 0
5 ,,	3 15 0
6 ,,	4 17 0
7 ,,	6 0 0
8 ,,	7 5 0
9 ,,	8 15 0
10 ,,	10 10 0
11 ,,	12 5 0
12 ,,	14 0 0



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Bore.	Price.
2 inches	£1 10 0
3 ,,	2 5 0
4 ,,	3 0 0
5 ,,	3 16 0
6 ,,	4 14 0
7 ,,	5 14 0
8 ,,	6 16 0
9 ,,	8 0 0
10 ,,	9 6 0
11 ,,	10 14 0
12 ,,	12 4 0

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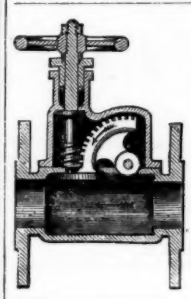

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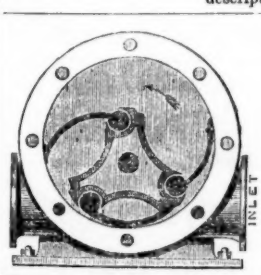

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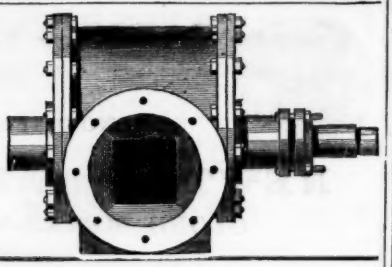

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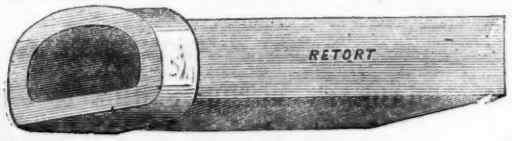

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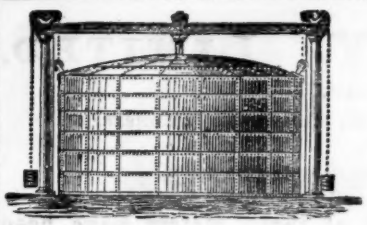

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